Planning of Water Resources of Rajasthan State

Report Number:

4.9

Report Name:

Comprehensive Water Resources Plan

Background: Over 2013-2014, a consortium of firms led by Tahal Group produced a set of reports on the subject for the Government of Rajasthan. 9 reports were produced, as follows:

Report No.	Report Name
4.1	Hydrology and Weather
4.2	Basin-wise water availability
4.3	Catchment area study
4.4	Groundwater
4.5	Water pollution
4.6	Water supply demand
4.7	Identification of new projects
4.8	Identification of projects to be rehabilitated
4.9	Comprehensive water resources plan

With some exceptions, all the above reports have been uploaded on archive.org and may be found by searching for "Planning of Water Resources of Rajasthan State"

Final Report No. 4.9

Volume 1 of 3

Report

Contents

Page

Table of Contents I
Abbreviations and Acronyms XV
Executive Summary i
1. INTRODUCTION 1
1.1 Background 1
1.2 Project Objectives 1
1.2.1 Purpose 2
1.2.2 Scope of Work 2
1.2.3 Reporting Requirement 3
1.3 Review of Earlier Studies 4
1.4 This Report 4
1.5 General Approach and Methodology 4
1.6 Data Availability and Reliability 5

Chapter 2 Page

2. TERRESTRIAL ELEMENTS 1
2.1 Physiography 1
2.2 Drainage 2
2.3 Geology 3
2.3.1 Introduction 3
2.3.2 Aravalli Super Group 4
2.3.3 Delhi Super Group 5
2.3.4 Vindhyan Super Group 5
2.4 Structure 7
2.5 Hydrogeological Units 9

Chapter 3 Page

3. CLIMATE 1
3.1 Introduction 1
3.2 Temperature 1
3.3 Rainfall 7
3.4 Evaporation 11
3.5 Wind Speed 14
3.6 Sunshine Hours 16
3.7 Relative Humidity 18
3.8 Impact of change of various weather parameters on State as a whole 21
3.9 Summary of Agroclimatic Zone-wise Analysis of Weather Trends 21
3.9.1 Methodology 21
3.9.2 Results 22
3.10 Impact of Change in Weather and Future Strategies 27
3.10.1 Impact of Change in Weather Parameters on Cropping Pattern, Productivity and Water Resources 27
3.10.2 ACZ wise futuristic strategies in view of change in weather 30

Chapter 4 Page

4. AGROCLIMATIC ZONES OF RAJASTHAN 1
4.1 Introduction 1
4.2 Arid Western Plain (Ia) 4
4.3 Irrigated North-Western Plains (Ib) 4
4.4 Hyper-Arid and Irrigated Western Plain Partially (Ic) 5
4.5 Transitional Plain of Inland Drainage (IIa) 5
4.6 Transitional Plain of Luni Basin (IIb) 5
4.7 Semi-arid Eastern Plain (IIIa) 6
4.8 Flood-Prone Eastern Plains (IIIb) 6
4.9 Sub-humid Southern Plains and the Aravalli Hills (IVa) 7

4.10 Humid Southern Plains (IVb) 7
4.11 Humid South-Eastern Plains (V) 8

Chapter 5 Page

5. RIVER BASINS OF RAJASTHAN 1
5.1 Introduction 1
5.2 Shekhawati Basin 4
5.3 Ruparail Basin 6
5.4 Banganga Basin 8
5.5 Gambhir Basin 10
5.6 Parbati Basin 11
5.7 Sabi Basin 13
5.8 Banas Basin 14
5.9 Chambal Basin 19
5.10 Mahi Basin 23
5.11 Sabarmati Basin 27
5.12 Luni Basin 29
5.13 West Banas Basin 34
5.14 Sukli Basin 36
5.15 Other Nallahs of Jalore Basin 37
5.16 Ghaggar Basin 39
5.17 Outside Basin 40

Chapter 6 Page

6. ADMINISTRATIVE SETUP 1

Chapter 7 Page

7. LANDUSE AND SOILS 1

Chapter 8 Page

8. POPULATION 1
8.1 Introduction 1
8.2 Demographic Scenario 1
8.3 Size, Growth Rate and Distribution of Population 2
8.4 Decadal Variation in Rajasthan Population Since 1901 2
8.5 Population Density 3
8.6 Urbanization 3
8.7 District wise and Basin wise Present Population 4
8.8 Population Projections 4
8.8.1 General 4
8.8.2 Methodology 4

CHAPTER 9PAGE

9. NON-AGRICULTURAL WATER DEMANDS 1
9.1 Introduction 1
9.2 Domestic and Institutional Water Demand 1
9.3 Livestock Water Demand 8
9.4 Wildlife Water Demand 20
9.5 Power Station's Cooling Water Demand 22
9.6 Industrial Water Demand 25
9.7 Summary 27

Chapter 10 Page

10. CROP WATER REQUIREMENT 1
10.1 The Modified Penman Method 1
10.2 Net Crop Water Requirement 1
10.3 Net Irrigation Demand 1

Chapter 11 Page

11. SURFACE WATER AVAILABILITY 1
11.1 Introduction 1
11.2 Data Collection and Validation 1

11.2.1 General 1
11.2.2 Data Collection and Validation 1
11.3 Modelling for Surface Waters Originating within Rajasthan 5
11.3.1 Development of Hydrological Model 6
11.4 Basin-Wise Natural (Virgin) Surface Water Assessment 6
11.4.1 Shekhawati Basin 6
11.4.2 Ruparail Basin 8
11.4.3 Banganga Basin 9
11.4.4 Gambhir Basin 10
11.4.5 Parbati Basin 11
11.4.6 Sabi Basin 12
11.4.7 Banas Basin 13
11.4.8 Chambal Basin 15
11.4.9 Mahi Basin 18
11.4.10 Sabarmati Basin 20
11.4.11 Luni Basin 21
11.4.12 West Banas Basin 25
11.4.13 Sukli Basin 26
11.4.14 Other Nallahs of Jalore Basin 26
11.4.15 Ghaggar Basin 27
11.4.16 Outside Basin 28
11.4.17 Summary of Basin-wise Virgin Surface Water Yield 30
11.5 Comparison of Current Study's Water Availability with Earlier TAHAL-WAPCOS Study (1998) 33
11.5.1 Introduction 33
11.5.2 Natural (Virgin) Surface Water Availability Comparison 33
11.6 Storage Created in River Basins of Rajasthan 35
11.7 Impact of Water Haresting Structures (WHSs) on Major, Medium and Minor Irrigation Projects 36
11.7.1 Introduction 36
11.7.2 Objective 36
11.7.3 Approach and Methodology 37
11.7.4 Major Outcomes of Detailed Catchment Areas Study 38
11.7.5 General Conclusions drawn from the study 40
11.7.6 Policy for future development of WHSs 40
11.7.7 Recommendations 41

Chapter 12 Page

12. IMPORTED SURFACE WATER 1
12.1 General 1
12.2 Outside Basin (including Ghaggar Basin) North Schemes 3
12.2.1 Ravi-Beas-Sutlej (RBS) Waters 3
12.2.2 Gang Canal System 4
12.2.3 Bhakra Canal System 5
12.2.4 Nohar-Sidhmukh System 6
12.2.5 Indira Gandhi Nahar Project (IGNP) 7
12.2.6 Water Utilization 8
12.2.7 Ghaggar River Basin 14
12.2.8 Ganga River Water 26
12.3 Yamuna River Water Import System (Gurgaon & Bharatpur Canal) 27
12.4 Chambal River System 30
12.4.1 General Setup 30
12.4.2 Proposed Further Development 33
12.5 Mahi River System 34
12.5.1 General Setup 34
12.5.2 Utilization of Water Potential 35

12.6 Narmada System 36
12.7 Imported Surface Water at various Dependability 38
12.8 Shortage of Imported Water Received in Rajasthan 39
12.8.1 Recent Water Sharing Statements 39
12.8.2 Imported Water during 2009-10 51

Chapter 13 Page

13. GROUNDWATER AVAILABILITY 1
13.1 Introduction 1
13.2 Data Collection and Validation 1
13.2.1 Data Collection 1
13.2.2 Data Validation 2
13.2.3 Completion of Missing Data 3
13.3 Basin-wise Hydrogeological Units 4
13.4 Depth to Ground Water Level 6
13.4.1 Depth to Ground Water Level (Pre-Monsoon 2010) 6
13.4.2 Depth to Ground Water Level (Post-Monsoon 2010) 6
13.5 Static Ground Water Level and Flow Direction 7
13.6 Groundwater Quality 7
13.7 Dynamic Groundwater Resources 12
13.7.1 Assessment Methodology 12
13.7.2 Basin-wise Dynamic Groundwater Resources 13
13.8 Static Groundwater Resources 22
13.8.1 Assessment Methodology 22
13.8.2 Basin-wise Static Groundwater Resources 22
13.9 Basin-wise Groundwater Scenario 23
13.9.1 Shekhawati Basin 23
13.9.2 Ruparail Basin 24
13.9.3 Banganga Basin 24
13.9.4 Gambhir Basin 25
13.9.5 Parbati Basin 25
13.9.6 Sabi Basin 26
13.9.7 Banas Basin 26
13.9.8 Chambal Basin 27
13.9.9 Mahi Basin 27
13.9.10 Sabarmati Basin 28
13.9.11 Luni Basin 28
13.9.12 West Banas Basin 29
13.9.13 Sukli Basin 29
13.9.14 Other Nallahs of Jalore Basin 30
13.9.15 Ghaggar Basin 30
13.9.16 Outside Basin 31
13.10 Comparison of Current Study's Water Availability with Earlier TAHAL-WAPCOS Study (1998) 31
13.10.1 Introduction 31
13.10.2 Dynamic Groundwater Availability Comparison 32

Chapter 14 Page

14. WATER POLLUTION 1
14.1 General 1
14.2 Surface Water Quality Status and Trend 1
14.3 Groundwater Quality Status and Trend 2
14.4 Water Quality Survey 5
14.5 Assessment of Domestic Pollution Loads 6
14.6 Assessment of Industrial Pollution 7
14.7 Diffuse Pollution Management 8

Chapter 15 Page
15. IMPROVEMENT PLANS 1
15.1 Introduction 1
15.2 Methodology 1
15.2.1 General 1
15.2.2 Project Planning Sheet 2
15.2.3 CMLP Model 2
15.2.4 Crops' Income Per Hectare Projections 4
15.2.5 Unit Cost Analysis for Rehabilitation Works 4
15.3 Appraisal of the Identified Project for Rehabilitation 4
15.3.1 General 4
15.3.2 Surface Water Availability 5
15.3.3 Groundwater Availability 5
15.4 Outcome of Economic Analysis 7
15.5 Project's Prioritization 8
15.5.1 Prioritization Factors 8
15.5.2 Weights attribution to prioritizing factors 9
15.5.3 Prioritization 10
Chapter 16 Page
16. DEVELOPMENT PLANS 1
16.1 Introduction 1
16.2 Approach and Methodology 2
16.2.1 Planning Guidelines 2
16.2.2 General Approach 3
16.2.3 Methodology for Search of Surplus Water 4
16.3 Search for Under-utilised / Surplus Water Resources 7
16.3.1 Shekhawati River Basin 8
16.3.2 Ruparail River Basin 9
16.3.3 Banganga River Basin 10
16.3.4 Gambhir River Basin 10
16.3.5 Parbati River Basin 11
16.3.6 Sabi River Basin 12
16.3.7 Banas River Basin 12
16.3.8 Chambal River Basin 13
16.3.9 Mahi River Basin 14
16.3.10 Sabarmati River Basin 14
16.3.11 Luni River Basin 15
16.3.12 West Banas River Basin 16
16.3.13 Sukli River Basin 16
16.3.14 Other Nallahs of Jalore River Basin 17
16.3.15 Ghaggar River Basin 18
16.3.16 Outside Basin 19
16.3.17 Summary of Search for Under-utilised / Surplus Surface Water 20
16.4 Identification of New Water Projects 22
16.4.1 Introduction 22
16.4.2 Project Appraisal Procedure 22
16.4.3 Identified New Projects 26
16.4.4 Inter-basin Water Transfer / River Linking Projects 26
Chapter 17 Page
17. WATER SUPPLY AND DEMAND BALANCE 1
17.1 Introduction 1
17.2 Methodology 2
17.3 Priorities 2
17.4 Water Balance Assessments 2
17.4.1 Satisfaction of the Non-agricultural Demand 4

17.4.2 Supply Coverage of the Irrigated Agricultural Demand 11

Chapter 18 Page

18. CONCLUSIONS AND RECOMMENDATIONS 1
18.1 General 1
18.2 Action Plan Based on Recommendations 1

Chapter 19 Page

19. POLICIES AND REGULATIONS 1
19.1 Introduction 1
19.2 Existing Policies and Regulations 1
19.2.1 Policies 1
19.2.2 Regulations 3
19.3 Initiatives 5
19.3.1 Development and implementation of effluent standards and Water quality criteria 5
19.3.2 National River Action Plan (NRAP) 6
19.3.3 Environment Impact Assessment 6
19.3.4 Special Drive for 17 categories of polluting industries 6
19.3.5 Pollution Control in Small-Scale Industries 6
19.3.6 Charters on Corporate Responsibility on Environment Protection 7
19.3.7 Special Drives for Industries Discharging into Rivers and Lakes 7
19.3.8 Incentives for Control of Pollution 7
19.3.9 Field Operational Manual for Environment Management of Water Resources Projects, February 2013 8
19.3.10 Environmental Management Guidelines and Action Plan of SWRPD for Water Sector in Rajasthan, February 2013 8
19.4 Strategies for Implementation 9
19.4.1 Present Approach to Water Pollution Control 12
19.4.2 Use of the Water Quality Classification System 12
19.4.3 Industrial Pollution Control 13
19.4.4 Pollution Control in Small-Scale Industries 14
19.5 Adequacy in Enforcement 14
19.6 Ecology and Environmental Flows 14
19.7 Major Constraints to Pollution Control 16
19.7.1 Legal and Administrative Constraints 16
19.7.2 Resource and Social Constraints 19
19.7.3 Technical Constraints 19
19.7.4 Information Constraints 19
19.8 Proposed Policy Initiatives 20
19.8.1 Policy to Address Pollution Abatement 20
19.8.2 Industrial Pollution Control 21
19.8.3 Market Based Instruments (MBI) 22
19.8.4 Capacity Building 23
19.8.5 Wastewater as a Resource 24
19.8.6 Policy to Address Water Resources Augmentation in the Basin 24
19.8.7 Policy Reforms for Drinking Water Supply Sector 26
19.8.8 Policy for Industrial Water Use 26
19.8.9 Policy for Environmental Flows in Rajasthan 26

■■■

List of Figures

		Chapter 2 Page
Figure 2.1	Geological Map	Following Page 4
Figure 2.2	The hydrogeological map of Rajasthan State	Following Page 10
		Chapter 3 Page
Figure 3.1	Mean Daily Maximum and Minimum Temperatures per Year	4
Figure 3.2	Mean Daily Maximum and Minimum Temperatures per Month	4
Figure 3.3	Mean Daily Highest Maximum and Lowest Minimum Temperatures per Year	6
Figure 3.4	Mean Daily Highest Maximum and Lowest Minimum Temperature per Month	6
Figure 3.5	Mean Annual Daily Maximum Temperature	Following Page 8
Figure 3.6	Mean Annual Daily Minimum Temperature	Following Page 8
Figure 3.7	Mean Annual Highest Maximum Temperature	Following Page 8
Figure 3.8	Mean Annual Lowest Maximum Temperature	Following Page 8
Figure 3.9	Mean monsoon (jun-jul-aug-sep) rainfall	Following Page 8
Figure 3.10	Mean annual rainfall	Following Page 8
Figure 3.11	Mean annual rainy days	Following Page 8
Figure 3.12	Rajasthan Raingauges – Monsoon Rainfall Trend	Following Page 10
Figure 3.13	Annual Evaporation During 1990-2009	12
Figure 3.14	Mean Monthly Evaporation	13
Figure 3.15	Daily Means of Wind Speeds from 1990 to 2009	15
Figure 3.16	Mean Daily Wind Speed per Month	16
Figure 3.17	Mean Daily Sunshine Hours from 1990 to 2009	18
Figure 3.18	Mean Daily Sunshine Hours per Month	18
Figure 3.19	Mean Daily Relative Humidity in % per Year, 1990 - 2009	20
Figure 3.20	Mean Daily Relative Humidity per Month	20
Figure 3.21	Mean Annual Evaporation	Following Page 26
Figure 3.22	Mean Annual Daily Relative Humidity	Following Page 26
Figure 3.23	Mean Annual Daily Sunshine Hours	Following Page 26
Figure 3.24	Mean Annual Daily Wind Speed	Following Page 26
		Chapter 4 Page
Figure 4.1	Map of block and districts within Agro-climatic zone and river basins	Following Page 4
		Chapter 5Page
Figure 5.1	Rajasthan River Basins	3
		Chapter 7 Page
Figure 7.1	Graphical Representation of State Landuse Percentages	1
Figure 7.2	Soil types by clay, silt and sand composition	5
		Chapter 11 Page
Figure 11.1	Entire State Natural (Virgin) Annual Surface Water Yield Dependability	32
		Chapter 12 Page
Figure 12.1	Ghaggar River Basin in Rajasthan State	15
Figure 12.2	Ghaggar River Basin Flood Control Works	18
Figure 12.3	Year 1976 Monsoon Yield Diagram for Ghaggar River System in Rajasthan	23
		Chapter 13 Page
Figure 13.1	Depth to Ground Water Level Map of Rajasthan State (Pre-Monsoon 2010)	Following Page 14
Figure 13.2	Depth to Ground Water Level Map of Rajasthan State	Following Page 14

	(Post-Monsoon 2010)	
Figure 13.3	Static Water Level Map of Rajasthan State (Pre-Monsoon 2010)	Following Page 14
Figure 13.4	Distribution of Chloride in Groundwater (Pre-Monsoon 2010)	Following Page 14
Figure 13.5	Distribution of Electrical Conductivity Of groundwater (Pre-Monsoon 2010)	Following Page 14
Figure 13.6	Distribution of Nitrate in Groundwater (Pre-Monsoon 2010)	Following Page 14
Figure 13.7	Distribution of Fluoride in Groundwater (Pre-Monsoon 2010)	Following Page 14
Figure 13.8	Basin-wise Stage of Groundwater Development	21
Figure 13.9	Categorization of Blocks as per Ground Water Assessment, 2010	Following Page 24
Figure 17.1	State Non-Agricultural Demand and Supply for Planning Stages 2010, 2020, 2040, 2060 and Dependability levels 25%, 50%, 75%, 90%, in Mm^3/yr	10
Figure 17.2	Total Domestic Unmet Demand per District for a Dependability level of 90% in 2060, in Mm^3/yr	11
Figure 17.3	State Agricultural Demand and Supply Inside CCA for Planning Stages 2010, 2020, 2040, 2060 and Dependability levels 25%, 50%, 75%, 90%, in Mm^3/yr	13
Figure 17.4	State Agricultural Demand and Supply Outside CCA for Planning Stages 2010, 2020, 2040, 2060 and Dependability levels 25%, 50%, 75%, 90% and Considering Full Potential in Mm^3/yr	13
Figure 17.5	State Agricultural Demand and Supply Outside CCA for Planning Stages 2010, 2020, 2040, 2060 and Dependability levels 25%, 50%, 75%, 90% and Considering Maximum Irrigated Areas in Past Decade (2002-2010), in Mm^3/yr	14

■■■

List of Tables

		Chapter 2 Page
Table 2.1	Geological Succession of Rock Formations in Rajasthan	3
Table 2.2	Major 19 Hydrogeological Formations and their Areas in Rajasthan	9
Table 2.3	General Aquifer Characteristics of 19 Hydrogeological Formations	10
Table 2.4	Aquifer-wise Ground Water Level Fluctuation in Rajasthan	11
		Chapter 3 Page
Table 3.1	Maximum and Minimum Temperature Statistics in Rajasthan	1
Table 3.2	Mean Daily Maximum and Minimum Temperatures per Year	2
Table 3.3	Mean Daily Maximum and Minimum Temperatures by Months	2
Table 3.4	Mean Highest Daily Maximum and Lowest Minimum Temperatures by year	5
Table 3.5	Mean Daily Highest Maximum and Lowest Minimum	5

	Temperatures by Months	
Table 3.6	Rainfall Statistics in Rajasthan	7
Table 3.7	District-wise Monsoon Rainfall, Mean Annual Rainfall and Number of Rainy Days	8
Table 3.8	District-Wise IMD Monthly Normal Rainfall	9
Table 3.9	District-Wise IMD Normal Number of Rainy Days	9
Table 3.10	Mean Annual Evaporation for Rajasthan State	11
Table 3.11	Mean Monthly Evaporation for Rajasthan State	12
Table 3.12	District-Wise Mean Monthly Evaporation	13
Table 3.13	Mean Daily Wind Speed per Year	14
Table 3.14	Mean Daily Wind Speed per Month	15
Table 3.15	Mean Daily Sunshine Hours per Year in Rajasthan	16
Table 3.16	Mean Daily Sunshine Hours per Month	17
Table 3.17	Mean Daily Relative Humidity per Year	19
Table 3.18	Mean Daily Relative Humidity per Month	19
Table 3.19	Agroclimatic Zone-wise Summary of Recommendations for Irrigation Methods	34
		Chapter 4 Page
Table 4.1	Salient Features of the Agroclimatic Zones of Rajasthan	2
		Chapter 5 Page
Table 5.1	Basins and Sub-basins of Rajasthan State	1
Table 5.2	Area Details of Shekhawati Basin	4
Table 5.3	Weather Parameter Statistics for Shekhawati Basin	5
Table 5.4	Area Details of Ruparail Basin	7
Table 5.5	Weather Parameter Statistics for Ruparail Basin	7
Table 5.6	Area Details of Banganga Basin	8
Table 5.7	Weather Parameters Statistics of Banganga Basin	9
Table 5.8	Area Details of Gambhir Basin	10
Table 5.9	Weather Parameter Statistics for Gambhir Basin	11
Table 5.10	Area Details of Parbati Basin	12
Table 5.11	Weather Parameter Statistics for Parbati Basin	12
Table 5.12	Area Details of Sabi Basin	13
Table 5.13	Weather Parameter Statistics for Sabi Basin	14
Table 5.14	Area Details of Banas Basin	17
Table 5.15	Weather Parameter Statistics of Banas Basin	19
Table 5.16	Area Details of Chambal Basin	21
Table 5.17	Weather Parameter Statistics for Chambal Basin	23
Table 5.18	Area Details of Mahi Basin	25
Table 5.19	Weather Parameter Statistics of Mahi Basin	26
Table 5.20	Area Details of Sabarmati Basin	28
Table 5.21	Weather Data Statistics for Sabarmati Basin	29
Table 5.22	Area Details of Luni Basin	31
Table 5.23	Weather Parameter Statistics for Luni Basin	34
Table 5.24	Area Details of West Banas Basin	35
Table 5.25	Weather Parameter Statistics for West Banas Basin	35
Table 5.26	Area Details of Sukli Basin	36
Table 5.27	Weather Parameter Statistics for Sukli Basin	37
Table 5.28	Area Details of Other Nallahs of Jalore Basin	38
Table 5.29	Weather Parameter Statistics for Other Nallahs of Jalore Basin	38
Table 5.30	Area Details of Ghaggar Basin	40
Table 5.31	Weather Parameters Statistics of Ghaggar Basin	40
Table 5.32	Area Details of Outside Basin	41
Table 5.33	Weather Parameters Statistics for Outside Basin	43

		Chapter 6 Page
Table 6.1	Districts and Blocks of Rajasthan	1
Table 6.2	Districts Falling Under Various River Basins of Rajasthan	7
		Chapter 7 Page
Table 7.1	Land Uses as Percentage of State Area	1
Table 7.2	Categories of Landuse and their Areas in River Basins of Rajasthan	2
Table 7.3	Categories of Landuse and their Areas in Districts of Rajasthan	3
Table 7.4	Categories of Soil Type and their Areas in River Basins of Rajasthan	7
		Chapter 8 Page
Table 8.1	Socio-Demographic Profile, India and Rajasthan	1
Table 8.2	Percentage Decadal Variation in Rajasthan Population 1901-2011	2
Table 8.3	Population Density in Rajasthan, 1901-2011	3
Table 8.4	Annual Growth Rates	4
Table 8.5	Sub-Basin-wise Present (2010) and Projected Population	5
Table 8.6	Basin-wise Present (2010) and Projected Population	9
Table 8.7	District-wise Present (2010) and Projected Population	11
		Chapter 9 Page
Table 9.1	Projected River Basin Population and Gross Domestic Water Demand	2
Table 9.2(a)	Combined Basin wise Domestic and Institutional Gross Water Demand	4
Table 9.2(b)	Combined District wise Domestic and Institutional Gross Water Demand	6
Table 9.3(a)	Basin-wise Projected Livestock Population for year 2010	10
Table 9.3(b)	Basin-wise Projected Livestock Population for year 2020	11
Table 9.3(c)	Basin-wise Projected Livestock Population for year 2040	12
Table 9.3(d)	Basin-wise Projected Livestock Population for year 2060	13
Table 9.3(e)	District-wise Projected Livestock Population for year 2010	14
Table 9.3(f)	District-wise Projected Livestock Population for year 2020	15
Table 9.3(g)	District-wise Projected Livestock Population for year 2040	16
Table 9.3(h)	District-wise Projected Livestock Population for year 2060	17
Table 9.3(i)	State-wise Livestock Present (2010) and Projected Population	18
Table 9.4(a)	Basin-wise Present (2010) and Projected Livestock Water Demand	18
Table 9.4b)	District-wise Present (2010) and Projected Livestock Water Demand	19
Table 9.5(a)	Basin-wise Present (2010) and Projected Wildlife Water Demand	20
Table 9.5(b)	District-wise Present (2010) and Projected Wildlife Water Demand	21
Table 9.6	State Owned (RVUNL) Power Generation Plants Up to 2010	22
Table 9.7	Other Than State Owned Power Generation Plants Up to 2010	23
Table 9.8(a)	Basin-wise Present (2010) and Projected Water Demand for Power Stations	24
Table 9.8(b)	District-wise Present (2010) and Projected Water Demand for Power Stations	24
Table 9.9(a)	Basin-wise Present (2010) and Projected Industrial Water Demand	26

Table 9.9(b)	District-wise Present (2010) and Projected Industrial Water Demand	26
Table 9.10	Basin-wise Summary of Non-Agricultural Water Demands	27
		Chapter 10 Page
Table 10.1	District-wise weighted net crop water requirement	2
		Chapter 11 Page
Table 11.1	Virgin Water Yield at Four Dependability Levels – Shekhawati Basin	7
Table 11.2	Virgin Water Yield at Four Dependability Levels – Micro-watersheds of Shekhawati Basin	7
Table 11.3	Virgin Water Yield at Four Dependability Levels – Ruparail Basin	8
Table 11.4	Virgin Water Yield at Four Dependability Levels – Micro-watersheds of Ruparail Basin	8
Table 11.5	Virgin Water Yield at Four Dependability Levels – Banganga Basin	9
Table 11.6	Virgin Water Yield at Four Dependability levels of Micro-watersheds of Banganga Basin	9
Table 11.7	Virgin Water Yield at Four Dependability Levels – Gambhir Basin	10
Table 11.8	Virgin Water Yield at Four Dependability Levels - Gambhir Basin	10
Table 11.9	Virgin Water Yield at Four Dependability Levels – Parbati Basin	11
Table 11.10	Virgin Water Yield at Four Dependability Levels – Micro-watersheds of Parbati Basin	11
Table 11.11	Virgin Water Yield at Four Dependability Levels – Sabi Basin	12
Table 11.12	Virgin Water Yield at Four Dependability Levels – Micro-watersheds of Sabi Basin	12
Table 11.13	Virgin Water Yield at Four Dependability Levels – Banas Basin and its Sub-basins	13
Table 11.14	Virgin Water Yield at Four Dependability Levels – Micro-watersheds of Banas Basin	14
Table 11.15	Virgin Water Yield at Four Dependability Levels – Chambal Basin and its Sub-basins	16
Table 11.16	Virgin Water Yield at Four Dependability Levels – Micro-watersheds of Chambal Basin	16
Table 11.17	Virgin Water Yield at Four Dependability Levels – Mahi Basin and its Sub-basins	18
Table 11.18	Virgin Water Yield at Four Dependability Levels – Micro-watersheds of Mahi Basin	18
Table 11.19	Virgin Water Yield at Four Dependability Levels – Sabarmati Basin and its Sub-Basins	20
Table 11.20	Virgin Water Yield at Four Dependability Levels – Micro-watersheds of Sabarmati Basin	20
Table 11.21	Virgin Water Yield at Four Dependability Levels – Luni Basin and its Sub-Basins	22
Table 11.22	Virgin Water Yield at Four Dependability Levels – Micro-watersheds of Luni Basin	23
Table 11.23	Virgin Water Yield at Four Dependability Levels – West Banas Basin	25
Table 11.24	Virgin Water Yield at Four Dependability Levels – Micro-watersheds of West Banas Basin	25
Table 11.25	Virgin Water Yield at Four Dependability Levels – Sukli	26

	Basin	
Table 11.26	Virgin Water Yield at Four Dependability Levels – Micro-watersheds of Sukli Basin	26
Table 11.27	Virgin Water Yield at Four Dependability Levels – Other Nallahs of Jalore Basin	27
Table 11.28	Virgin Water Yield at Four Dependability Levels for Micro-watersheds of Other Nallahs of Jalore Basin	27
Table 11.29	Virgin Water Yield at Four Dependability Levels – Ghaggar Basin	27
Table 11.30	Virgin Water Yield at Four Dependability Levels – Micro-watersheds of Ghaggar Basin	28
Table 11.31	Virgin Water Yield at Four Dependability Levels – Outside Basin and its Sub-basins	28
Table 11.32	Virgin Water Yield at Four Dependability Levels – Micro-watersheds of Outside Basin	28
Table 11.33	Rajasthan State Natural (Virgin) Surface Water Yield	30
Table 11.34	Current to Earlier (C/E) Comparison of Simulated Natural (Virgin) Surface Water Yield	33
Table 11.35	Existing Storage in River Basins of Rajasthan	35
Table 11.36	Basin wise Summary of Water Surplus and Deficient Major/Medium Projects	39
		Chapter 12 Page
Table 12.1	Inter-State Agreements related to Imported Surface Water	2
Table 12.2	Claimed Share in Inter-State Waters	3
Table 12.3	Water Availability of North Outside Basin (including Ghaggar Basin) Scheme	9
Table 12.4	Combined Use of Ravi, Beas and Sutlej Rivers Water in Rajasthan	9
Table 12.5	Abstract of Basin States Share Account of Ravi Beas Water as maintained by BBMB	10
Table 12.6	Abstract of Basin States Share Account and Utilization of Sutlej Water as per BBMB	12
Table 12.7	Availability of Water from River Ghaggar	14
Table 12.8	Maximum Water Levels in Ghaggar Depressions from Year 1972 to 2010	19
Table 12.9	Annual and Monsoon (June through September)	21
Table 12.10	Monthly Average Normal Rainfall (1980-2010) June through October	21
Table 12.11	Monsoon and Non-Monsoon Runoff in Ghaggar River Downstream of Ottu Weir	24
Table 12.12	Yamuna River Flow at Selected Dependability Levels	27
Table 12.13	Seasonal Interim Water Allocation between Yamuna River Basin States	28
Table 12.14	Salient Features of Considered Storage Dams	28
Table 12.15	Modified Tentative Seasonal Distribution of Yamuna River Water to Rajasthan	29
Table 12.16	Rajasthan's Proposed Option for Monsoon Period Yamuna Water Abstraction	29
Table 12.17	State-wise Share of Chambal River Watershed	30
Table 12.18	Dependability Levels of Chambal River Yield	30
Table 12.19	Water Released to Rajasthan and MP in 1994/95 to 2009/10	32
Table 12.20	Water Release to Gujarat Before and after Commencement of Power Houses	35
Table 12.21	Allocation of Narmada System Water by NWDT in	37

	December 1979	
Table 12.22	Applied Statistics for Sardar Sarovar Dam	37
Table 12.23(a)	Imported Surface Water Availability to Rajasthan as per inter-State Agreements	38
Table 12.23(b)	Basin-wise Present Imported Surface Water Availability to Rajasthan	38
Table 12.24	Water Utilization by Partner States	39
Table 12.25	Abstract of Ravi Beas Water Account of Partner States as per BBMB	41
Table 12.26	Abstract of Shares and Utilization by Partner States of Sutlej Water as per BBMB	43
Table 12.27	Utilization Statement of Yamuna Water in Bharatpur District (all values in cuseddays, unless specified)	45
Table 12.28	Chambal Water Release to MP and Rajasthan for the last 14 years (1994/95 to 2009/10)	49
Table 12.29	Water Received through Narmada Canal as of March 2008	50
Table 12.30	Water Received from other States during 2009-10	51
		Chapter 13 Page
Table 13.1	Hydrogeological Units in River Basins of Rajasthan	4
Table 13.2	District-wise Area and Percentage of Area falling under different range of Chloride (Pre-monsoon 2010)	8
Table 13.3	District-wise Area and Percentage of Area falling under different range of EC (Pre-monsoon 2010)	9
Table 13.4	District-wise Area and Percentage of Area falling under different range of Nitrate (pre-monsoon 2010)	10
Table 13.5	District-wise Area and Percentage of Area falling under different range of Fluoride (Pre-monsoon 2010)	11
Table 13.6	Basin-wise Dynamic Groundwater Resources of Rajasthan (Year 2010)	13
Table 13.7	Basin-wise Stage of Groundwater Development (Year 2010)	14
Table 13.8	Block-wise/District-wise Stage of Groundwater Development (Year 2010)	15
Table 13.9	Various Parameters Adopted for Estimation of Static Groundwater Resources	22
Table 13.10	Basin-wise Static Groundwater Resources of Rajasthan (Year 2010)	22
Table 13.11	Current to Earlier (C/E) Comparison of Assessments of Total Dynamic Groundwater Availability	32
		Chapter 15 Page
Table 15.1	Projects Selected for Detailed Appraisal for Rehabilitation	6
Table 15.2	Economic indicators for existing irrigation projects	7
Table 15.3	Sets of weights attribution to prioritizing factors	10
Table 15.4	Rank Numbers by Attributes Project Wise	11
Table 15.5	Final ranking of project by two weights attribution approaches	13
		Chapter 16 Page
Table 16.1	Surplus Water at 75% dependability in Shekhawati Basin	9
Table 16.2	Surplus Water at 75% Dependability in Ruparail Basin	9
Table 16.3	Surplus Water at 75% Dependability in Banganga Basin	10
Table 16.4	Surplus Water at 75% Dependability in Gambhir Basin	11
Table 16.5	Surplus Water at 75% Dependability in Parbati Basin	11
Table 16.6	Surplus Water at 75% Dependability in Sabi Basin	12
Table 16.7	Surplus Water at 75% Dependability in Banas Basin	13

Table 16.8	Surplus Water at 75% Dependability in Chambal Basin	13
Table 16.9	Surplus Water at 75% Dependability in Mahi Basin	14
Table 16.10	Surplus Water at 75% Dependability in Sabarmati Basin	15
Table 16.11	Surplus Water at 75% Dependability in Luni Basin	15
Table 16.12	Surplus Water at 75% Dependability in West Banas Basin	16
Table 16.13	Surplus Water at 75% dependability in Sukli Basin	16
Table 16.14	Surplus Water at 75% Dependability in Other Nallahs of Jalore Basin	17
Table 16.15	Summary of Search for Under-utilised / Surplus Surface Water	20
Table 16.16	Summary of Proposed Projects	27
		Chapter 17 Page
Table 17.1	Objects and Parameters used in Simulation	4
Table 17.2	Analysis of Supply Coverage of Non-agricultural Demand	4
Table 17.3	Analysis of Supply Coverage of Irrigated Agricultural Demand	12
		Chapter 18Page
Table 18.1	Action Plan based on Recommendations	2
		Chapter 19 Page
Table 19.1	Use Based Classification of Surface Waters in India	12
Table 19.2	Recommended Environmental Flows as per the norms of MoEF	15

■■■

List of Appendices

Appendix 1	Review of Earlier Studies
Appendix 2	Rainfall Stations after Validation
Appendix 3	Weather Stations
Appendix 4(a)	Basin-wise Salient Features of Existing Major Projects
Appendix 4(b)	Basin-wise Salient features of Existing Medium Projects
Appendix 4(c)	Basin-wise Salient Features of Existing Minor Irrigation projects
Appendix 5(a)	Inventory of Ongoing Projects
Appendix 5(b)	Inventory of Proposed Projects
Appendix 6	River Gauge and Discharge (G&D) Sites
Appendix 7	Water Harvesting Structures (WHSs) in Rajasthan
Appendix 8	Micro-watershed wise Groundwater Availability

■■■

List of Maps

Map 1	Surface Water Key Map
Map 2	Map of Development Plans
Map 3	Map of Improvement Plans
Map 4	Main Features of Blocks related to Water Balance
Map 5	Main Features of Micro-watersheds related to Water Balance

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Abbreviations and Acronyms

ACZ	Agro Climatic Zone
amsl	Above Mean Sea Level
B/C	Benefit-Cost
BCM	Billion Cubic Metres
BFS	Base Flow Series
bgl	Below Ground Level
B as U	Business as Usual
BOD	Biochemical Oxygen Demand
Bm^3	Billion Cubic Metres (also BCM)
CCA	Culturable Command Area
CETP	Common Effluent Treatment Plant
CGWB	Central Ground Water Board
CMLP	Crop Mix Linear Programming
CPCB	Central Pollution Control Board
CREP	Corporate Responsibility for Environmental Protection
CSR	Commencement-of-Sowing Rains
cumec	Cubic Metre per Second
CV	Coefficient of Variation
CWC	Central Water Commission
DDP	Drought Development Programme
DEM	Digital Elevation Model
DPA	Drought-prone areas
DPSP	Directive Principles of State Policy
DST	Department of Science and Technology
d/s	Downstream
EC	Electrical Conductivity
EIA	Environment Impact Assessment
EMP	Environmental Management Plan
EPA	Environment (Protection) Act
ET	Evapotranspiration
ETO	Exploratory Tubewell Organization
ETP	Effluent Treatment Plant
FAO	Food and Agriculture Organization
FRA	Free Remaining Area
FRL	Full Reservoir Level
FSL	Full Supply Level
GAP	Ganga Action Plan
GCA	Gross Command Area

GIS	Geographical Information System
G&D	Gauge and Discharge
GDP	Gross Domestic Product
GoR	Government of Rajasthan
GSI	Geological Survey of India
GW	Ground Water
ha	Hectare
hr	Hour
ID	Irrigation Department (of Rajasthan)
IDRI	Investigation, Design and Research (Irrigation) Unit, Rajasthan
IFS	Intervened Flow Series
IGNP	Indira Gandhi Nahar Project
IMD	India Meteorological Department
LP	Linear Programming
IWMI	International Water Management Institute
JJAS	June-July-August-September
km^2	Square kilometre
LMC	Left Main Canal
lpm	Litre per minute
lps	Litre per second
m	metre
m^2	Square metre
m^3	Cubic metre
mbgl	metre below ground level
m^2/day	Square metre per day
MINAS	Industry Specific Minimum National Standards
MLD	Million Litre per day
m^3/sec	Cubic metre per second
m^3/hr	Cubic metres per hour
Mha	Million hectares
Mm^3	Million cubic metres
Mm^3/yr	Million cubic metres per year
mm	millimetre
MP	Madhya Pradesh State
MRS	Monthly Runoff Simulation
MSME	Micro, Small and Medium Enterprises
MSW	Municipal Solid Waste
MW	Megawatt
MWS	Micro Watersheds
N	North
Na	Not applicable, or: Not available
NARP	National Agriculture Research Project
n.d.	No data

NE	North East
NGO	Non-Governmental Organisation
NLCP	National Lake Conservation Plan
NNE	North-North East
NPP	National Population Policy
NPV	Net Present Value
NPZ	Non Potential Zone
NRSC	National Remote Sensing Centre
NR	Non-Reporting / Natural Replenishment
NRCD	National River Conservation Directorate
NRCP	National River Conservation Plan
NW	Northwest
O & M	Operation and Maintenance
ONGC	Oil and Natural Gas Corporation
PBO	Pilot Balloon Observatory
PCC	Pollution Control Committee
PHED	Public Health Engineering Department
ppm	Parts per million
PPPs	Public-Private Partnerships
PRI	Panchayat Raj Institutions
PS	Panchayat Samiti
PS	Planning Stage
PZ	Potential Zone
R&R	Resettlement & Rehabilitation
RGWD	Rajasthan Ground Water Department
RH	Relative Humidity
RIBASIM	River Basin Simulation Model
RIICO	Rajasthan Industrial Development and Investment Corporation
RL	Reduced Level
RMC	Right Main Canal
RSEB	Rajasthan State Electricity Board
RSPCB	Rajasthan State Pollution Control Board
RSRSAC	Rajasthan State Remote Sensing Application Centre
RVUNL	Rajasthan Vidhyut Utpadan Nigam Limited
RWA	Residence Welfare Association
RWSRP	Rajasthan Water Sector Restructuring Project
S	South / Storativity
SAR	Sodium Adsorption Ratio
SAR	Staff Appraisal Report
SC	Scheduled Castes
SCS	Soil Conservation Service
SPCB	State Pollution Control Board
SRSAC	State Remote Sensing Application Centre (Rajasthan)
SRTM	Shuttle Radar Topographic Mission
SSW	South-South West
ST	Scheduled Tribes

STP	Sewage Treatment Plant
SW	Surface Water; South-west
SWAT	Soil and Water Assessment Tool
SWL	Static Water Level
SWP	State Water Policy
SWRPD	State Water Resources Planning Department
TDS	Total Dissolved Solids
ToR	Terms of Reference
TPP	Thermal Power Plant
TPS	Thermal Power Station
UA	Urban Agglomeration
UIFS	Un-intercepted Flow Series
ULB	Urban Local Body
UP	Uttar Pradesh State
u/s	Upstream
WAPCOS	Water and Power Consultancy Services (India) Ltd.
WEAP	Water Evaluation And Planning
WHS	Water Harvesting Structure
WLF	Water Level Fluctuation
WRD	Water Resources Department
WRGIS	Water Resources Geographical Information System
WRIS	Water Resources Information System
WRPD	Water Resources Planning Department
WUA	Water Users Association
yr	Year

Executive Summary

Project Background

The State Water Policy of Government of Rajasthan, February 2010, provides for development of its Water resources in a well planned way. All new projects shall be planned based on micro watershed planning basis so as to ensure equity in use of surplus water. It is on this account that the Government of Rajasthan took up study to review and update all River Basin Master Plans for the integrated development and management of all its water resources. In this connection necessary provision of funds were made in EC funded State Partnership Program (SPP) under implementation in Rajasthan State.

The earlier comprehensive study on water planning for different river basins in Rajasthan State was carried out by TAHAL-WAPCOS Consultants during year 1994-1998. This study was considered quite old and had much reduced relevance in today's context. The present study therefore envisages to take-up review and fresh planning of all the water resources of Rajasthan based on updated water resources data and modern techniques now available in this field of study encompassing all necessary provisions made in the new water policy of the State Government.

The purpose of this assignment is to prepare a long term plan and policy for development and management of the water resources of the State of Rajasthan, both surface (internal and external) and ground water, on comprehensive and integrated basis. The period of planning envisaged is 2010-2060.

Scope of Work

1. Data Collection
2. Analysis of Agroclimatic Zone wise hydrology, temperature over a period of 20 years, find all changes in precipitation, no. of rainy days, rainfall intensity, temperature, humidity and the impact on water resources, cropping pattern and productivity and suggest futuristic strategies for water uses, cropping pattern, in view of the changes.
3. Study the basin wise / sub-basin wise water availability (at various dependabilities) both surface and ground water (including interstate share of Rajasthan from Ravi, Beas, Satluj, Chambal, Mahi and Yamuna Water), indicate changes as compared to the earlier TAHAL-WAPCOS Study with reasons for change.
4. Carry out detailed study of the catchment areas of all major, medium and minor irrigation projects, identify the WHSs constructed and the watershed works carried out and mark the same on GIS mapping with requisite hydrological details and assess their impact on water flows to the project, study the transevaporation of these small water bodies and resultant water loss, their impact on ground water recharging and suggest a future policy for construction of such structures in the catchment area.
5. Agroclimatic Zone wise ground water basins studies, delineation of aquifers on microshed basis, marking them on the GIS mapping Panchayat Samiti wise

and Village wise, based on the present exploitation and recharging of aquifers compute the remaining life of the aquifer so that this information could be disseminated Panchayat Samiti & Village wise.

6. Estimate the quantity of Water Pollution (Rivers, Industrial, Municipal etc.) Source wise, District wise and indicate costs of reclamation / treatment and possible uses.
7. Prepare Districtwise and Blockwise plans of supply and demand of water for various uses, crops, strategies to fill gap and estimated costs.
8. Identification of new projects in water surplus basins based on scientific study and survey and based on socio economic viability criteria.
9. Identification of projects for rehabilitation and/ or modernisation for existing major and medium projects based on socio economic viability criteria.
10. Preparation of comprehensive full scale integrated water resources plan for the State as a whole.
11. Imparting training to the staff and officers of SWRPD & WRD on planning and on use of software used in the study.

Integrated State Water Resources Plan

This report on Integrated State Water Resources Plan is the last one in the series of nine Final Reports. The objective of this report is to present a comprehensive full scale integrated plan for the State as a whole as well as to summarize the various aspects covered under other reports of this study on Planning of Water Resources of Rajasthan State and their conclusions and recommendations in form of an Action Plan highlighting responsible agencies for execution of the plans.

Project Related Features of Rajasthan

Rajasthan is the largest state in the Indian Union, with an area of 342,264 km^2. It is located in northwest India between longitudes 69°29’ and 78°17’ East and latitudes 23°30’ and 30°11’ North. The Tropic of Cancer passes through Rajasthan south of Banswara town.

Rajasthan features a variety of landforms, which have resulted from erosional and depositional processes over a long geological time period. Four major physiographic divisions have been identified in the State:

- Aravalli Hill Ranges,
- Eastern Plains,
- The Thar Desert, and
- The South Eastern Plateau.

The topography, rainfall, and geology are the most important factors affecting the extent and orientation of drainage, in Rajasthan in general and within a basin in particular.

The geological sequence of the State is highly varied and complex, showing the co-existence of the most ancient rocks of Pre-Cambrian age and the most recent alluvium, as well as wind-blown sands of Quaternary to Recent age.

A total of 19 hydrogeological units have been identified on the basis of CGWB and RGWD data base. The significant and mapable hydrogeological units are considered to serve the purposes of water resources planning. The hydrogeological units were delineated using water-bearing formation data of CGWB and RGWD. The same have been delineated on micro-watershed, using GIS, and also panchayat samiti-wise (block-wise) and village-wise.

Major 19 Hydrogeological Formations and their Areas in Rajasthan

S. No.	Hydrogeological Units / Hills	Area, Km^2
1	Younger Alluvium	48,070.05
2	Older Alluvium	94,968.09
3	Tertiary Sandstone	24,502.65
4	Deccan Traps (Basalt)	9,580.51
5	Jurassic Sandstone (Lathi, Parihar, Baisakhi, Bhadesar)	15,213.07
6	Vindhyan Sandstone (Nagaur, Jodhpur)	25,675.64
7	Bilara Limestone	9,522.51
8	Bhander Sandstone	13,954.29
9	Limestone (Alwar, Bhander, Upper Cretaceous)	4,853.08
10	Shale	3,906.68
11	Quartzite	5,325.02
12	Slate	367.65
13	Phyllite & Schist	35,728.18
14	Gneisses	1,967.40
15	Jalore Granite	5,612.72
16	Erinpura Granite	5,229.75
17	Rhyolite	5,046.40
18	Ultra Basics	107.72
19	Gneisses(B.G.C.)	21,724.31
20	Hills	10,908.08
	Total	342,263.80

Climate

Average annual rainfall of the state is 604 mm and average annual monsoon rainfall is 531 mm. The state has large variance in the climatic conditions. The distribution of rainfall, both over time and area, is highly uneven and erratic. The extreme hydrological events, floods and droughts, are usual features for the State.

The maximum temperature is highest in (37.4°C) the pre-monsoon season, while it is lowest (25.7°C) in cold weather season. Mean annual maximum temperature in Rajasthan is 33.2°C with a range of 25.7°C - 35.0°C. Minimum temperature attains its Mean highest value (25.1°C) during monsoon season, while it attains its Mean lowest value (9.6°C) in cold weather season. Mean annual Minimum temperature within Rajasthan is 19.1°C with a range of 11.8°C - 21.8°C.

Highest Maximum temperature attains its maximum value during Pre-Monsoon season (44.7°C) while it is lowest during Cold Weather season (34.6°C). Lowest Minimum temperature attains it lowest value during Cold weather (1.2°C) while it is highest during Monsoon season (17.8°C).

The highest mean monthly rainfall occurs in the middle months of July and August, with 198.4 and 164.0 mm respectively in each month, contributing about 67.1% of the annual rainfall, while June and September rainfalls contribute 10.5% and 14.0%, respectively. It is observed that contribution of the other three seasons to annual rainfall is marginal. Winter, pre-monsoon and the post-monsoon seasons contribute 2.2%, 3.4% and 2.8%, respectively.

Evaporation in Rajasthan is highly variable, both in spatial and temporal terms. Annual evaporation ranges from 140 cm to over 300 cm over the State. Values exceeding 300 cm occur over western Rajasthan (observed at the IMD weather station in Jaisalmer), which mainly comprises a desert area. It is generally the highest during May (when it ranges from about 26 cm to 43 cm) over most parts of the State and continues to be high in June too. The minimum usually occurs in December and January, when evaporation ranges from about 4 cm to 12 cm per month.

Relative humidity follows a sinusoidal pattern, decreasing from 54.7% in January to a minimum of 30.5% in April, increasing to a maximum of 72.6% in August, and again decreasing to 48.4% in October.

Trend analysis of different weather parameters have been studied during the past 20 years and impact of change in weather parameters on cropping pattern, productivity and water resources and future strategies in view of change in weather have been presented in detail in Final Report No. 4.1 and summarized in Chapter 3 of this report.

Agroclimatic Zones (ACZs)

There are 10 Agroclimatic Zones in Rajasthan namely: (Ia) Arid Western Plain, (Ib) Irrigated North Western Plain, (Ic) Hyper Arid Irrigated Western Plain Partially, (IIa) Transitional Plain of inland drainage, (IIb) Transitional Plain of Luni Basin, (IIIa) Semi arid Eastern Plain, (IIIb) Flood Prone Eastern Plain, (IVa) Sub humid Southern Plain, (IVb) Humid Southern Plain and (V)Humid South-Eastern Plain.

River Basins

In current study basin, sub-basin and micro-watershed boundaries have been delineated for the entire State using SRTM DEM (Shuttle Radar Topographic Mission, 90 m resolution data). Historically watersheds were delineated manually. This process is labour intensive, slow, tedious, inconsistent and error-prone. DEM-based techniques can efficiently form the basis of a geographic information system designed to address watershed based analysis. Applications to benefit from these techniques include evaporation modelling, tracing drainage paths and hydrologic simulation modelling.

Accordingly, 15 defined river basins and remaining area of Rajasthan has been defined as Outside Basin (designated as basin No.16) have been delineated, which differ in their sizes and potentialities. Within these river basins 58 sub-basins and 541 micro watershed have been delineated for the study purpose.

River Basins of Rajasthan State

S. No.	River Basin	Area, km²	Number of Sub-basins	Number of Micro-watersheds	Remarks
1	Shekhawati	9,750.88	3	25	Originates from Sikar, Jaipur and Ajmer district in Rajasthan, partly drains to northeast (Haryana State), partly southwest to Sambhar Lake
2	Ruparail	4,033.66	1	14	Originates from Alwar district in Rajasthan, drains towards Yamuna River
3	Banganga	8,583.34	1	32	Originates from Jaipur district in Rajasthan, drains towards Yamuna River
4	Gambhir	4,693.52	1	16	Originates from Karauli district in Rajasthan, drains to Yamuna River
5	Parbati	1,887.07	1	20	Originates from Karauli district in Rajasthan, drains to Gambhir River
6	Sabi	4,523.67	1	20	Originates from Sikar and Jaipur district in Rajasthan, drains to northeast (Haryana State)

S. No.	River Basin	Area, km^2	Number of Sub-basins	Number of Micro-watersheds	Remarks
7	Banas	47,060.27	10	71	Originates from Rajsamand district in Rajasthan, drains to Chambal River
8	Chambal	31,242.50	7	67	Originates in Madhya Pradesh, flows through south-east Rajasthan and drains to Yamuna River
9	Mahi	16,610.63	6	59	Flows through southern part of Rajasthan, but originates in Madhya Pradesh and continues to adjacent state (Gujarat)
10	Sabarmati	4,130.12	4	15	Originates from Udaipur district in Rajasthan, drains to southwest (Gujarat State)
11	Luni	69,302.10	12	94	Originates from Nagaur district in Rajasthan, drains to Rann of Kuchh (Gujarat State)
12	West Banas	1,831.34	1	14	Originates from Sirohi district in Rajasthan, drains to southwest (Gujarat State)
13	Sukli	990.44	1	11	Originates from Sirohi district in Rajasthan, drains to southwest (Gujarat State)
14	Other Nallahs of Jalore	1,900.27	1	9	Several streams originating from Jalore and Sirohi district in Rajasthan, some draining to southwest (Gujarat State)
15	Ghaggar	5,201.51	1	2	Originates in Himachal Pradesh, flows through Haryana and Punjab and enters north Rajasthan in Hanumangarh district and drains through Ganganagar district to Pakistan
16	Outside Basin	130,522.48	7	72	Western Rajasthan Thar Desert (not actually a river basin)
Total		**342,263.80**	**58**	**541**	

Population and Various Water Demands

Rajasthan is divided into seven administrative divisions and 33 districts. The districts are further divided into 244 Tehsils and 249 Blocks. More than almost half of all the inhabited villages in the State, numbering 44,672, have fewer than 500 inhabitants each. About 25% of ~69 million population of the State resided in 297 towns in 2011. The methodology adopted for population projections has been considered viable by the consultant as that being adopted by the Statistical Department of Govt. of Rajasthan in population projections. The present and projected population of Rajasthan is shown as follows.

Rajasthan Present and Projected Population, in millions				
Type	2010	2020	2040	2060
Rural	51.50	60.43	75.84	85.18
Urban	17.05	20.71	27.63	32.59
Total	68.55	81.14	103.47	117.77

By pertinent nature, non-agricultural water demand values are reflected in terms of administrative division of the State, i.e. Districts and Blocks. The water demands calculated for various non-agricultural sectors (i.e. Domestic, Institutional, Industrial, Livestock, Wildlife and Power) either on Block level or on specific locations were transferred to Basins / Sub-Basins using GIS overlay techniques.

For assessing domestic water demand, for the year 2010, the Consultants have adopted the norms established by the PHED, as follows, in litres per capita per day (lpcd).

Rural Water Supply

70 lpcd in DDP Blocks of Rajasthan
40 lpcd in non-DDP Blocks

Urban Water Supply

135 lpcd in towns having a population of more than 20,000
100 lpcd in towns having a population of less than 20,000

Revised norms of Water Supply

As per new guidelines of NRDWP issued by MORD, Govt. of India, the norms for future has been taken as below.

(A) Domestic Water Demand of Urban Population

For water demand of major towns having population more than 5.0 lac, a norm of 150 lpcd has been taken, as sewerage system are to be executed along with drinking water supply in these towns.

(B) Domestic Water Demand of Rural Population

To cover maximum habitation through piped water supply schemes, the above norms have been replaced with 100 lpcd in DDP blocks and 70 lpcd in non DDP blocks for planning water demand for rural population due to future needs of conversion of existing drinking water schemes (from present hand pump schemes, pump and tank etc. to Piped Water Supply Schemes in maximum possible habitations).

The domestic water demand is calculated separately for Urban and Rural areas for each Block. Urban water demand is calculated for Towns / Cities and Rural domestic water demand calculated for Blocks. Further, the gross demand was estimated by considering 30 losses in urban areas and 10% losses in rural areas. The relation between Block and Basin / Sub-Basin has been achieved by GIS on area proportional basis; accordingly, the rural gross water demand has been

transferred to Basin / Sub-Basin level. Concerning urban areas (i.e. Town / City), their location in terms of micro watershed has been achieved by GIS, and per case basis of their location in relevant Basin / Sub-Basin, the urban gross water demand has been transferred. The institutional demand has been considered as 5% of gross domestic demand.

On the basis of available data of livestock census for 12 times (1951 to 2007), the trend diagrams for the various main categories of domestic animals, such as cattle, buffalos, sheep, goats, camels, pigs, poultry and remaining others (dogs, horses, donkeys, rabbits etc.) have been plotted and projected for the year 2010, 2020, 2040 and 2060.

According to information from Animal Husbandry Department the daily water consumption by different animals is as follows.

	lpcd
Cows	65
Buffaloes	65
Sheep	6
Goats	5
Horses	60
Asses	60
Camels	65
Pigs	17
Ducks	3
Rabbits	0.3
Elephants	150
Poultry	0.25

On the basis of water demand per capita per day given above, the water demand for different categories of livestock has been worked out District wise and Block wise. The relation between Block and Basin / Sub-Basin has been achieved by GIS on area proportional basis, accordingly, the livestock water demand has been transferred to Basin / Sub-Basin level.

The total number of wild animals as per the 2010 census is 261,233 or 0.26 million. This number is very small in comparison with the livestock which is 56.59 million, plus some other livestock such as dogs, horse, donkeys, poultry, rabbits etc. Thus, the number of wildlife can be taken as about 0.46% of livestock. But water is also needed by other unaccounted wildlife. Therefore, a provision of 1% of livestock water demand is considered by the Consultants as proper for a realistic assessment of water demand for wildlife. Hence, wildlife water requirements are taken as 1% of livestock demand (in each planning stage) for the state as a whole, and this value has been distributed between the blocks in proportion to the forest areas in these blocks for the year 2010. The relation between Block and Basins / Sub-Basins has been achieved by GIS on area proportional basis, accordingly, the wildlife water demand has been transferred to Basins / Sub-Basins level.

The cooling water requirement for power sector has been assessed for specific locations where power plants exist as per data of RVUNL and other reports. The

location of power plants in terms of Basins / Sub-Basins has been achieved by GIS, accordingly, the power station's cooling water demand has been duly transferred on its location in Basins / Sub-Basins.

The Rajasthan State Industrial Development and Investment Corporation (RIICO) have assessed industrial water demand on the basis of industrial area developed. The present industrial water requirements have been estimated at 4.54 m^3 per acre per day (i.e. 11.22 m^3 per ha per day) of industrial area developed. On the basis of norms of RIICO, the industrial water demand for industries in RIICO area scattered in various blocks of Rajasthan has been worked out. Besides it, there are many industries outside the RIICO area at various locations. For the industries outside RIICO area it has been assumed that their requirement would be 20% of the water demand of the RIICO area. Besides it, at some, locations, there are industries having more than 20% industrial area and having more water demand than that of RIICO area. Such information collected from industry department and from WRD reports of 2009, have been incorporated while working out water demand outside RIICO area. The projections have been made for the year 2020, 2040 and 2060. It is anticipated that, due to globalization there would be rapid expansion of industries which will result increase in water demand also. It has been estimated that there would be 25% more water demand in the next decade. Hence while projecting water demand 25% increase per decade has been considered. The future projections of water demand for industries district-wise and block-wise have been worked out. Since, the water requirement for industrial sector has been calculated on specific locations where clusters of industries exist. The location of the industrial units (cluster) in terms of Basins / Sub-Basins has been achieved by GIS, accordingly, the industrial water demand has been transferred by its location in Basins / Sub-Basins.

Adopting the above water requirement norms for various non-agricultural water sectors, the present and projected demand has been estimated and summarized for Rajasthan below.

Planning Stage, Year	Non-Agricultural Water Demands, Mm^3/yr					
	Domestic (including Institutional)	Livestock	Wildlife	Power	Industrial	Total
2010	2,357.64	624.75	20.25	353.59	297.13	3,653.36
2020	3,671.33	663.99	20.64	897.16	376.28	5,629.40
2040	4,762.32	742.41	21.42	1,265.61	587.92	7,379.68
2060	5,477.81	821.62	22.22	1,722.18	918.66	8,962.49

Gross irrigation water demands have been computed by applying the factors of on-farm and off-farm irrigation efficiency to the net irrigation water demand for individual surface-water-irrigated projects CCA and areas outside the CCA of surface-water-irrigated projects in each block / micro-watershed, considering the type of water source. The data related to on-farm and off-farm efficiency for present situation has been taken as per existing condition of projects, while for future improved efficiency figures resulting from implementation of suggested rehabilitation and upgrading measures have been considered.

Water Resources

The State's water resources are categorised in following terms:

- SW: Surface water (stream flows) generated from within Rajasthan boundaries;
- ISW: Imported water delivered to Rajasthan from other states by means of several projects under relevant inter-state agreements;
- GW: Groundwater, in terms of Dynamic and Static availability (fresh as well as saline), while for planning purposes only fresh Dynamic groundwater has been considered for utilization.

The share of Rajasthan in out of State rivers as per various inter-State agreements is shown below.

River	Allocated Share		Date of Agreement	Parties to the Agreement
	Maf/yr	Mm^3/yr		
1. Canal/Feeder Import				
1.1 Ravi-Beas-Sutlej Systems				
Ravi Beas (pre-partition)	1.11	1,369	04.09.1920	British Govt., Nawab of Bhawalpur & Maharaja of Bikaner
Ravi Beas	8.60	10,608	31.12.1981	Haryana, Punjab & Rajasthan
Sutlej	1.41	1,739	13.01.1959	Punjab & Rajasthan
Sub-total	**11.12**	**13,716**		
1.2 Yamuna System	0.91	1,119	12.05.1994	Delhi, Himachal Pradesh, Haryana, Rajasthan & Uttar Pradesh
1.3 Narmada System	0.50	617	07.12.1979	Gujarat, Maharashtra Madhya Pradesh & Rajasthan
Total Canal/Feeder Import	**12.53**	**15,452**		
2. Shared River Basin				
Chambal	1.60	1,973		Madhya Pradesh & Rajasthan
Mahi	0.37	454	10.01.1966	Gujarat & Rajasthan
Total Shared River Basin	**1.97**	**2,427**		
3. River Tail (without formal agreement)				
Ghaggar	0.40	489		Spontaneous flows

In the earlier study by TAHAL-WAPCOS (1994-1998), surface water availability was evaluated with the help of the MRS model, which was developed by the Consultants at that stage. For the present study, the MRS model was replaced by SWAT model for hydrological modelling (Soil and Water Assessment Tool).

The SWAT is a distributed parameter and continuous time simulation model. It has been developed to predict the response of water and sediment yields to natural inputs as well as man-made interventions in un-gauged catchments. The model is (a) physically based, (b) uses readily available inputs, (c) computationally efficient

to operate and, (d) time-continuous and capable of simulating long periods to compute the effects of basin management changes.

Surface water availability within each basin, sub-basin and micro-watershed has been evaluated with the help of the model used for the analysis. Water availability for each basin, sub-basin and micro-watershed has been evaluated at 25%, 50%, 75% and 90% climatic dependability levels.

The methodology of village-wise dynamic groundwater resources assessment is based on application of GIS based analysis and adopting GEC (1997) methodology. The groundwater resources estimation methodology (GEC'97) which utilises water level fluctuation method is used based on concept of storage change due to differences between input and output components, where input refers to recharge from rainfall and other sources and output refer to ground water drainage and abstraction. The total fresh and saline dynamic groundwater resources of the State for year 2010 has been estimated as 10,613.84 and 3,621.99 Mm^3/yr. The Consultant also assessed the present (2010) groundwater draft based on village wise wells data collected from Tehsils, which works out to 15,200.86 Mm^3. Considering the net annual fresh dynamic groundwater availability and groundwater draft, the present (2010) stage of groundwater development has been estimated as 143.22%.

The static groundwater resources have been estimated by applying the following formula:
Static groundwater resources = effective potential zone area of the aquifer × utilizable saturated thickness × specific yield

Average depth of the basement and utilizable saturated thickness of the different hydrogeological formations have been adopted on the basis of the values as reported by the respective field hydrogeologist of the respective areas and used in the static groundwater assessment, year 2008. The static groundwater resources for the year 2010 have been calculated by adopting same criteria as indicated above. The total static ground water resources occurring below the lowest fluctuating levels of ground water as permanent resource are estimated at 32,914.18 Mm^3 for fresh areas and 29,725.51 Mm^3 for saline areas of the State.

The basin/sub-basin/micro-watershed wise values were calculated from village-wise assessed values using GIS, considering villages falling fully or partially (in such cases values were taken on area proportion basis) within the basin/sub-basin/micro-watershed.

The assessed mean annual surface water (including inter-State share of Rajasthan) and ground water availability is shown in following table.

Assessed Mean Annual Surface and Ground Water Availability (including inter-State share of Rajasthan)

S. No.	Basin	Mean Annual Virgin Water Yield within Rajasthan, Mm^3	Imported water to Rajasthan as per inter-State Share, Mm^3				Mean Annual Groundwater Resources, Mm^3			
			Received at Rajasthan Border for Agriculture Use	Conveyance Losses upto Rajasthan Border	Reserved for Non-Agriculture Use	Total	Dynamic		Static	
							Fresh	Saline	Fresh	Saline
1	Shekhawati	562.85				0.00	433.35	22.70	1,196.66	130.77
2	Ruparail	641.38	18.42	0.97		19.39	302.18	49.07	472.79	107.89
3	Banganga	754.83	32.08	1.69		33.77	525.76	147.19	813.57	280.35
4	Gambhir	700.89				0.00	428.21	29.78	478.18	56.82
5	Parbati	427.18				0.00	128.50	0.00	103.69	0.00
6	Sabi	348.09				0.00	429.89	6.93	698.56	13.69
7	Banas	5,097.26				0.00	2,282.73	107.65	1,808.90	90.42
8	Chambal	8,702.14	3,387.00			3,387.00	1,999.54	26.33	953.39	22.09
9	Mahi	3,720.25	699.62			699.62	604.88	0.00	108.82	0.00
10	Sabarmati	732.52				0.00	62.98	10.93	11.81	4.09
11	Luni	2,269.92	562.34	21.83	131.25	715.42	1,493.18	488.99	10,884.72	4,041.33
12	West Banas	222.14				0.00	69.63	4.26	7.44	0.89
13	Sukli	137.61				0.00	51.68	0.00	6.06	0.00
14	Other Nallahs of Jalore	51.42	165.33	6.42		171.75	115.28	0.00	705.82	0.00
15	Ghaggar	19.54	2,587.41 *	693.80	1,267.00	14,205.07	239.44	446.69	484.60	1,120.90
16	Outside Basin	990.60	9,656.86				1,446.61	2,281.47	14,179.17	23,856.27
State Total		**25,378.62**	**17,109.06**	**724.71**	**1,398.25**	**19,232.02**	**10,613.84**	**3,621.99**	**32,914.18**	**29,725.51**

* Including 489.07 Mm^3 of Ghaggar flood water.

Status of Irrigation Projects in Rajasthan

There are 24 major, 84 medium and 3,331 minor irrigation projects having live storage capacity of 6259.94 Mm^3, 2133.53 Mm^3 and 3448.92 Mm^3, respectively in 16 basins of Rajasthan (including Outside basin).

The high pressure on surface water, particularly upstream of existing catchment locations (storage reservoirs) seriously affected their purpose. During the course of this study, the Consultants have carried out detailed study of catchment areas of Major, Medium and Minor Irrigation Projects and studied the impact of WHSs on the project inflows.

It is observed that only 14 Major/Medium projects were found surplus namely Gambhiri of Banas Basin; Abhaypura, Bhimlat, Galwaniya, Gopalpura, Gudha, Harish Chandra Sagar, Jawahar Sagar, Parwan Lift, Parwan Pickup Weir, Parwati Pickup Wei and Ummed Sagar of Chambal Basin; Jakham and Surwania of Mahi Basin. Rest of the projects are classified as deficient as per above mentioned criteria. Within the deficient projects Ramgarh Dam, Kalakh Bund, Mata ji ka Khera, Chandra Bhaga, Phool Sagar Jalia, Girolia, Bisalpura are the ones which are badly affected due to upstream interventions.

Improvement Plans

The financial crunch in the last few decades has however resulted in ever deteriorating condition of most irrigation projects. Poor maintenance and water management have led to increasing water losses and reduction in irrigation system efficiencies as against their design norms.

There are 114 major and medium irrigation projects (considering Bhimlat-Abheypura as one and including canal projects having imported surface water). Out of the 114 Projects, 42 major and medium projects are under rehabilitation under RWSRP and performances of these projects show that they do not require further rehabilitation. For the projects which were commissioned recently, it has been observed that there is no requirement for rehabilitation and modernization due to area is not fully developed or open for irrigation. Therefore, the remaining project for which water is stored in reservoir at regular interval and is being used for irrigation are considered as projects for rehabilitation and studied in detail. Based on the detailed study of selected 35 projects, considering socio economic viability criteria, the Consultants have suggested rehabilitation for 25 Major/Medium Irrigation Projects.

Development Plans

According to surplus water availability assessment carried out on micro watershed level as per State Water policy, various plans/projects to utilize the surplus water were studied by the Consultants, keeping in view the minimum environmental flow requirements as per the norms of MoEF and socio economic viability criteria. Accordingly, new projects have been identified in Parbati basin, Banas basin, Chambal basin, and Mahi basin, keeping in view priority of drinking water requirements in scarcity areas.

Summary of Proposed Projects

S. No.	Project Code	Project Name	Latitude	Longitude	Basin	Sub-basin	Micro-watershed	Type of Project	Gross Capacity, Mm^3	CCA, ha	Estimated Cost, Million Rs.	Remarks
1	PAR-1	Artificial Groundwater Recharge Project	26°42'04.414"	77°43'10.501"	Parbati	Parbati	PAR MWS 002	WHS	9.28	-	46.05	15 percolation tanks & 57 cross-stream structures for groundwater recharge
2	BAN-1	Isarda Project	26°06'35.604"	76°00'25.020"	Banas	Banas	BAN MWS 002	Major	304.97	-	3,060.00	Drinking Water project
3	CHM-1	Parwan Project	24°35'45.420"	76°31'06.960"	Chambal	Kali Sindh	CHM MWS 039	Major	490.00	131,400	22,711.80	Multi-purpose project
4	CHM-2	Kali Sindh	24°29'52.188"	76°13'14.268"	Chambal	Kali Sindh	CHM MWS 035	Major	148.00	14,478	14,150.99	Multi-purpose project
5	CHM-3	Indira Lift	26°00'12.420"	76°49'08.148"	Chambal	Chambal Downstream	CHM MWS 005	Major	353.85	104,845	5,773.67	Drinking cum Irrigation Project
6	CHM-4	Dhaulpur Lift	26°39'42.264"	77°55'52.212"	Chambal	Chambal Downstream	CHM MWS 009	Major	74.70	34,465	1,279.50	Drinking cum Irrigation Project
7	CHM-5	Chambal-Panchna Lift	26°15'32.159"	77°14'23.657"	Chambal	Chambal Downstream	CHM MWS 005	Major	28.01	3,135	2,820.00	Inter-basin transfer for Drinking cum Irrigation purpose
8	CHM-6	Chambal to Jaisamand (Alwar) Lift	26°39'29.638"	77°54'02.812"	Chambal	Chambal Downstream	CHM MWS 010	Major	107.22	40,950	5,654.20	Inter-basin transfer for Irrigation purpose
9	CHM-7	Manohar Thana	24°13'06.744"	76°48'28.944"	Chambal	Kali Sindh	CHM MWS 042	Medium	84.76	14,049	2,471.13	Drinking cum Irrigation Project
10	CHM-8	Rajgarh Project	24°14'48.000"	75°53'15.000"	Chambal	Kali Sindh	CHM MWS 023	Medium	58.91	6,827	2,033.82	Drinking cum Irrigation Project
11	CHM-9	Mej to Ramgarh and Isarda Lift Scheme	25°34'27.844"	76°07'58.412"	Chambal	Mej	CHM MWS 052	Medium	317.59	60,080	19,829.54	Inter-basin transfer for Drinking cum Irrigation purpose
12	CHM-10	Hatiyadeh	25°15'56.844"	76°42'21.204"	Chambal	Parwati	CHM MWS 058	Medium	46.97	6,885	1,646.59	Drinking cum Irrigation Project
13	CHM-11	Andheri	24°34'36.768"	76°47'28.716"	Chambal	Parwati	CHM MWS 055	Medium	45.29	7,700	1,358.18	Drinking cum Irrigation Project
14	CHM-12	Pipalda Lift	25°54'37.728"	76°38'50.064"	Chambal	Chambal Downstream	CHM MWS 007	Medium	23.26	12,930	919.60	Drinking cum Irrigation Project
15	CHM-13	Bor Band	24°10'28.992"	76°31'38.460"	Chambal	Kali Sindh	CHM MWS 029	Minor	0.67	133	26.83	Irrigation project

S. No.	Project Code	Project Name	Latitude	Longitude	Basin	Sub-basin	Micro-watershed	Type of Project	Gross Capacity, Mm^3	CCA, ha	Estimated Cost, Million Rs.	Remarks
16	CHM-14	Guradia	24°24'38.052"	76°04'33.312"	Chambal	Kali Sindh	CHM MWS 026	Minor	4.49	1,509	232.67	Irrigation project
17	CHM-15	Rizone	24°21'30.744"	76°16'46.308"	Chambal	Kali Sindh	CHM MWS 035	Minor	0.63	129	25.52	Irrigation project
18	CHM-16	Anwa	24°55'43.212"	76°06'34.884"	Chambal	Kali Sindh	CHM MWS 033	Minor	0.76	187	35.32	Irrigation project
19	CHM-17	Bherupura	24°49'34.608"	76°25'33.780"	Chambal	Kali Sindh	CHM MWS 038	Minor	1.05	150	40.36	Irrigation project
20	CHM-18	Sathoor Mata	25°26'38.364"	75°31'06.204"	Chambal	Mej	CHM MWS 053	Minor	0.71	209	44.62	Irrigation project
21	CHM-19	Bada Nayagaon	25°30'35.244"	75°30'15.480"	Chambal	Mej	CHM MWS 053	Minor	5.96	606	237.13	Irrigation project
22	CHM-20	Radi	25°08'42.396"	76°52'06.636"	Chambal	Parwati	CHM MWS 060	Minor	4.92	901	229.83	Irrigation project
23	CHM-21	Neveli	25°09'19.368"	77°07'05.736"	Chambal	Parwati	CHM MWS 059	Minor	3.93	614	159.26	Irrigation project
24	CHM-22	Dohri	26°09'03.960"	76°55'38.604"	Chambal	Chambal Downstream	CHM MWS 005	Minor	8.11	1,002	239.70	Irrigation project
25	CHM-23	Gopal Sagar	26°20'59.568"	77°13'38.604"	Chambal	Chambal Downstream	CHM MWS 010	Minor	1.39	198	52.26	Irrigation project
26	CHM-24	Ram Sagar	26°22'58.188"	77°19'01.308"	Chambal	Chambal Downstream	CHM MWS 010	Minor	1.67	238	62.94	Irrigation project
27	CHM-25	Krishna Sagar	26°16'14.988"	77°06'15.156"	Chambal	Chambal Downstream	CHM MWS 005	Minor	7.07	1,012	264.66	Irrigation project
28	MAI-1	Anas to Jaisamand, Rajsamand, Meja & Bisalpur	23°26'19.277"	74°02'36.075"	Mahi	Anas	MAI MWS 001	Major	670.00	51,000	36,813.00	Inter-basin transfer for Drinking cum Irrigation purpose
29	MAI-2	Jakham to Jaisamand Dam (Udaipur)	23°38'10.739"	74°31'12.543"	Mahi	Mahi	MAI MWS 024	Major	132.00	8,000	730.47	Drinking cum Irrigation Project
30	MAI-3	Handa Khera	24°01'33.096"	74°21'53.424"	Mahi	Jakham	MAI MWS 011	Minor	13.97	1,998	527.49	Irrigation project
31	MAI-4	Tidiya Deh	23°14'11.868"	74°19'49.188"	Mahi	Anas	MAI MWS 004	Minor	2.70	347	76.55	Irrigation project
32	MAI-5	Moti-Tambi	23°17'18.000"	74°09'16.000"	Mahi	Anas	MAI MWS 002	Minor	2.52	232	98.59	Irrigation project
33	MAI-6	Dam at Anas River	23°20'27.794"	74°14'00.748"	Mahi	Anas	MAI MWS 002	Medium	63.12	-	1,560.32	Supplement to Mahi command

Water Supply and Demand Balance

According to the document State Water Policy (SWP), February 2010, State Water Resources Planning Department, Rajasthan, Jaipur, water allocation priorities for water resources management and planning purposes, are as follows:

human drinking water
livestock drinking water
other domestic, commercial and municipal water uses
agriculture
power generation
environmental and ecological
industrial
non-consumptive uses, such as cultural, leisure and tourist uses

The SWP also states that any departure from the above priorities will require consideration on a case-by-case basis.

The above water allocation priorities were followed while carrying out water supply and demand balance block-wise and micro watershed wise, which were aggregated to arrive at district level and basin/sub-basin level analysis. The analysis of district level results which presents the current and future unmet demand of the domestic, livestock, wildlife, industrial and power plant uses is presented below. It points out which blocks in each district have shortages along with plans to fill gaps and associated estimated cost.

District-wise Analysis of Supply Coverage of Non-agricultural Demand

S. No.	District	Supply coverage of the non-agricultural demand	Plans to fill gap with estimated cost
1	Ajmer	Although there is no non-agricultural unmet demand at present (year 2010), shortages will appear in the Peesangan block, where the Ajmer town is located, for future planning stages. Other smaller shortages will also occur from planning stage 2040 in Jawaja and Kishangarh blocks. The maximum non-agricultural unmet demand of the district is 60 Mm^3/yr.	It is proposed to transfer 300 Mm^3/yr water from Anas River in Mahi Basin to Berach River in Banas Basin to augment the Bisalpur Dam. The project also includes augmentation of Jaisamand Dam (Udaipur), Rajsamand Dam (Rajsamand) and Meja Dam (Bhilwara). The total estimated cost of the project is Rs. 3681.30 Crores.
2	Alwar	Although there is no non-agricultural unmet demand at present, small shortages appear in the Alwar town starting from planning stage 2040. The maximum non-agricultural unmet demand of the district is 19 Mm^3/yr.	It is proposed to transfer 21.16 Mm^3/yr water from Chambal River to augment the existing Jaisamand Bund (Alwar). The project also includes enroute requirement of Dhaulpur, Bharatpur and Alwar Districts. The total estimated cost of the project is Rs. 565.42 Crores.
3	Banswara	For all planning stages and dependability levels, there is no unmet demand for non-agricultural uses, except for the power plant in the Chhoti Sarvan block for a dependability level of 90% in 2060.	Inter-state agreement with Gujarat should be reviewed for additional utilization of water in Rajasthan from Mahi Bajaj Sagar Dam.
4	Baran	There is no non-agricultural unmet demand	These power plants future demands are to

S. No.	District	Supply coverage of the non-agricultural demand	Plans to fill gap with estimated cost
		except for Kawai and Chhabra power plants in future planning stages.	be met from proposed Parwan Major Irrigation Project. The estimated cost of Parwan Major Irrigation Project is Rs. 2271.10 Crores.
5	Barmer	There is currently a non-agricultural unmet demand in the majority of the blocks. This unmet demand reaches a maximum of about 104 Mm^3/yr for a dependability level of 90% in 2060.	The gaps will be fulfilled after completion of ongoing projects: 1) Barmer Lift Canal Water Supply Project Phase-I for providing drinking water supply to Barmer city, 412 villages of Barmer and 161 villages of Jaisalmer district from Indira Gandhi Main Canal with an estimated cost of Rs. 688.66 Crores, and 2) Pokaran Phalsoond Balotra Lift Water Supply Project for providing drinking water to Pokaran (in Jaisalmer district), Balotra and Siwana towns and 580 villages of Barmer and Jaisalmer districts from Indira Gandhi Main Canal with an estimated cost Rs.1444.20 Crores; and proposed project- Barmer Lift Project Phase-II to provide drinking water to 691 villages of Barmer district with an estimated cost of Rs. 797.75 Crores.
6	Bharatpur	There is no non-agricultural unmet demand, except for wildlife in the Keoladeo National Park.	There is an ongoing project to supply water to Keoladeo National Park from Goverdhan Drain which will fill this gap. The estimated cost of the project is Rs. 56.04 Crores. Also, there is an ongoing project - Chambal Dhaulpur Bharatpur Water Supply Project - to supply water to 945 villages in Bharatpur district and 96 villages in Dhaulpur district apart from urban towns of Dhaulpur (partial), Bharatpur, Kumher, Deeg, Nagar and Kaman. The estimated cost of the project is Rs. 477.99 Crores. This project will further strengthen the water supply scenario in Bharatpur district.
7	Bhilwara	Shortages appear for future planning stages in the Suwana block, where the Bhilwara town is located. In addition, the demand of the planned power plant in Mandalgarh block cannot be satisfied for all dependability levels. Thus, the maximum non-agricultural unmet demand of the district is 65 Mm^3/yr or 35 Mm^3/yr depending if the planned power plant is considered or not.	This gap shall be closed once the Chambal Bhilwara Water Supply Project is completed. The estimated cost of the project is Rs. 727.82 Crores. There is another proposed project aimed at transferring 84.0 Mm^3/yr water from Anas River (Mahi basin) to Meja Dam (Bhilwara). The project also includes augmentation of Jaisamand Dam (Udaipur), Rajsamand Dam (Rajsamand) and Bisalpur Dam (Tonk). The total estimated cost of the project is Rs. 3681.30 Crores. This will further augment the water availability in Bhilwara district.
8	Bikaner	There is no non-agricultural unmet demand.	-
9	Bundi	There is no non-agricultural unmet demand.	-

S. No.	District	Supply coverage of the non-agricultural demand	Plans to fill gap with estimated cost
10	Chittaurgarh	There is no domestic and livestock unmet demand but there are some shortages for the industry and power plant in the Chittaurgarh block.	There are gaps of small amount which can be fulfilled with proper water management.
11	Churu	There is non-agricultural unmet demand in the Sujangarh block, starting from planning stage 2040. For a dependability level of 90% in 2060, it reaches an amount of about 10 Mm^3/yr, out of which 7 Mm^3/yr affect the domestic demand.	A project named Aapni Yojana Phase-II is under consideration to cover 444 villages of Churu district and Jhunjhunu district and 6 towns of Churu district from Sahwa Lift Canal which takes off from Indira Gandhi Main Canal as source with an estimated cost of Rs. 1330.00 Crores. The shortages will be fulfilled after completion of this scheme.
12	Dausa	There is no non-agricultural unmet demand.	-
13	Dhaulpur	There is no non-agricultural unmet demand.	Also, there is an ongoing project - Chambal Dhaulpur Bharatpur Water Supply Project - to supply water to 945 villages in Bharatpur district and 96 villages in Dhaulpur district apart from urban towns of Dhaulpur (partial), Bharatpur, Kumher, Deeg, Nagar and Kaman. The estimated cost of the project is Rs. 477.99 Crores. This project will further strengthen the water supply scenario in Bharatpur district.
14	Dungarpur	There is no non-agricultural unmet demand.	-
15	Ganganagar	There is no non-agricultural unmet demand.	-
16	Hanumangarh	There is no non-agricultural unmet demand.	-
17	Jaipur	The present shortage for Jaipur City will keep increasing to reach a maximum of 240 Mm^3/yr, 370 Mm^3/yr and 450 Mm^3/yr of unmet demand, in 2020, 2040 and 2060 respectively for a dependability level of 90%. At planning stage 2040 and 2060, shortages will even occur for a dependability level of 25% reaching an amount of 35 Mm^3/yr and 120 Mm^3/yr respectively. The maximum total unmet demand for non-agricultural uses in Jaipur district is about 680 Mm^3/yr.	There is a proposed project, Isarda Dam, on Banas River downstream of Bisalpur dam to cater for future water supply to Jaipur city. The proposed gross storage capacity of the dam is 305 Mm^3 and the estimated cost is Rs. 306 Crores. There is another proposed project aimed at transferring of surplus water from Mej River (Chambal basin) near Lakheri in Bundi district to the Ramgarh dam in Jaipur district and Isarda Dam in Tonk district and enroute dams. The proposal envisages pumping of 317.59 Mm^3/yr of flood water from Mej River during the monsoon period into the Ramgarh Dam (28.0 Mm^3/yr), Isarda Dam (173.67 Mm^3/yr) and enroute dams. The estimated cost of project is Rs. 2137.86 Crores. It is also proposed to transfer 300 Mm^3/yr water from Anas River in Mahi Basin to Berach River in Banas Basin to augment the Bisalpur Dam. The project also includes augmentation of Jaisamand Dam (Udaipur), Rajsamand Dam (Rajsamand) and Meja Dam (Bhilwara). The total estimated cost of

S. No.	District	Supply coverage of the non-agricultural demand	Plans to fill gap with estimated cost
			the project is Rs. 3681.30 Crores Hence, to meet the huge demand of Jaipur city in future, the above projects should be implemented on priority.
18	Jaisalmer	There is some non-agricultural unmet demand starting from planning stage 2040, which reaches an amount of about 11 Mm^3/yr for a dependability level of 90% in 2060 and which is mainly located in the Sankra block.	The gaps will be fulfilled after completion of ongoing projects: 1) Barmer Lift Canal Water Supply Project Phase-I for providing drinking water supply to Barmer city, 412 villages of Barmer and 161 villages of Jaisalmer district from Indira Gandhi Main Canal with an estimated cost of Rs. 688.66 Crores, and 2) Pokaran Phalsoond Balotra Lift Water Supply Project for providing drinking water to Pokaran (in Jaisalmer district), Balotra and Siwana towns and 580 villages of Barmer and Jaisalmer districts from Indira Gandhi Main Canal with an estimated cost Rs.1444.20 Crores.
19	Jalore	There is no non-agricultural unmet demand.	-
20	Jhalawar	There is no non-agricultural unmet demand, except for the Kalisindh power plant, which is only a planned power plant and can be met after completion of Kalisindh project.	Completion of Kalisindh project with an estimated cost of Rs. 1415.10 Crores
21	Jhunjhunu	There are no domestic shortages for any dependability level and planning stage but unmet demand appear in the industrial sector of Khetri and Jhunjhunun blocks for planning stage 2040 and 2060. The maximum non-agricultural unmet demand of the district is 20 Mm^3/yr.	A project named Aapni Yojana Phase-II is under consideration to cover 444 villages of Churu district and Jhunjhunu district and 6 towns of Churu district from Sahwa Lift Canal which takes off from Indira Gandhi Main Canal as source with an estimated cost of Rs. 1330.00 Crores. With this scheme and proper water management, additional water will be available for industrial sector.
22	Jodhpur	There is no non-agricultural unmet demand.	-
23	Karauli	There is no non-agricultural unmet demand.	There is an ongoing project to cover 926 villages and four towns of Sawai Madhopur and Karauli district with an estimated cost of Rs. 468.18 Crores. This will further strengthen the drinking water supply scenario in Karauli district.
24	Kota	There is no non-agricultural unmet demand.	-
25	Nagaur	There is no non-agricultural unmet demand.	There as an ongoing project - Nagaur Lift Water Supply Project for 5 towns and 502 villages of Nagaur district. The estimated cost of project is Rs. 761.00 Crores.
26	Pali	There is some non-agricultural unmet demand, mainly located in the Pali block but also in the Rohat block. The maximum non-agricultural unmet demand of the district reaches an amount of about 35 Mm^3/yr for a dependability level of 90% in 2060, out of which 25 Mm^3/yr for domestic use.	There is an ongoing project to save water losses in open canal from Jawai dam to provide safe drinking water to additional 531 villages and 10 towns of Pali district by converting the existing canal system into pipeline from Jawai dam with an estimated cost of Rs. 634.79 Crores. Thus the

S. No.	District	Supply coverage of the non-agricultural demand	Plans to fill gap with estimated cost
			shortages can be fulfilled by conservation of water being lost in open canal flow through seepage, evaporation and pilferage.
27	Pratapgarh	There is no non-agricultural unmet demand.	-
28	Rajsamand	There are small shortages, located in Bhim, Railmagra and Rajsamand blocks. For planning stage 2020, small shortages of less than 3 Mm^3 appear in the industrial sector and then there is also an unmet demand as regards domestic and livestock uses. The maximum non-agricultural unmet demand of the district is 28 Mm^3/yr, out of which ~ 5 Mm^3/yr for domestic use.	There is a proposed project aimed at transferring 98.5 Mm^3/yr water from Anas River (Mahi basin) to Rajsamand Dam (Rajsamand). The project also includes augmentation of Jaisamand Dam (Udaipur), Meja Dam (Bhilwara) and Bisalpur Dam (Tonk). The total estimated cost of the project is Rs. 3681.30 Crores. This will further augment the water availability in Rajsamand district.
29	Sawai Madhopur	There is no major problem of shortages.	There is an ongoing project to cover 926 villages and four towns of Sawai Madhopur and Karauli district with an estimated cost of Rs. 468.18 Crores. This will further strengthen the drinking water supply scenario in Sawai Madhopur district.
30	Sikar	There are shortages in the Piprali block, where the Sikar town is located, for planning stage 2040 and 2060. The maximum non-agricultural unmet demand of the district is 28 Mm^3/yr.	There is a proposal, Fatehpur-Laxmangarh Project, to provide safe drinking water to the 3 towns (Fatehpur, Laxmangarh and Ramgarh) and 286 villages of Sikar district with IGNP as source. The estimated cost of the project is Rs. 832.00 Crores. To solve the shortage problem of Piprali block this proposal should include supply to Sikar town and villages of Piprali block also.
31	Sirohi	There is no non-agricultural unmet demand.	-
32	Tonk	There is no non-agricultural unmet demand.	-
33	Udaipur	There are shortages, mainly in the Girwa block, where the Udaipur City is located. The demand is entirely met only for a dependability level of 25% and 50% at present and for a dependability level of 25% in planning stage 2020. The maximum total unmet demand for non-agricultural uses in Udaipur district is 115 Mm^3/yr, out of which about 50 Mm^3/yr of domestic unmet demand in Udaipur City.	There is an ongoing project Dewas Stage-II which consists of construction of two dams (total storage capacity 10.97 Mm^3) near Akodra and Madri villages of Jhadol and Girwa tehsils, respectively of Udaipur district to augment drinking water supply to Udaipur city. The estimated cost of the project is Rs. 379.19 Crores. The Dewas Stage-III is proposed near village Nathiyathal, under this a dam of 13.08 Mm^3 and a 11.05 km long tunnel is to be constructed. Near village Ambawa is proposed the last and fourth Stage of the project in which a dam with a capacity of 15.26 Mm^3 and a tunnel 4.30 km long will be built. The estimated cost of the project is Rs. 568.15 Crores. Also a proposed project aimed at transferring 140.05 Mm^3/yr water from Anas River (Mahi basin) to Jaisamand Dam (Udaipur). The project also includes

S. No.	District	Supply coverage of the non-agricultural demand	Plans to fill gap with estimated cost
			augmentation of Rajsamand Dam (Rajsamand), Meja Dam (Bhilwara) and Bisalpur Dam (Tonk). The total estimated cost of the project is Rs. 3681.30 Crores. This will further augment the water availability in Udaipur district. There is another proposed project to transfer 131.93 Mm^3/yr water from Jakham Dam to Jaisamand Dam (Udaipur), which will further strengthen the water supply scenario in Udaipur district. The total estimated cost of project is Rs. 85.82 Crores.

Conclusion and Recommendations

During the course of Study on Planning of Water Resources of Rajasthan State the Consultant has prepared and submitted following Reports on various aspects of the Study:

One Inception Report
Seven Preliminary Reports
Eight Draft Final Reports
Nine Final Reports (including this report)
One Report on Training

The various aspects covered under Nine Final Reports depicted by its title are as follows:

Final Report No.	Title
4.1	Agroclimatic Zone-wise Hydrology and Weather
4.2	Basin / Sub- basin-wise Surface and Groundwater Availability
4.3	Detailed Study on Catchment Areas
4.4	Groundwater Study by Agroclimatic Zones
4.5	Water Pollution
4.6	Water Supply and Demand by Districts
4.7	Identification of New Projects in Water Surplus Basins
4.8	Identification of Projects to be Rehabilitated
4.9	Integrated State Water Resources Plan

Each Final Report (4.1 to 4.8) has been prepared in detailed manner with supporting data and includes specific Conclusions and Recommendations related to the subject matter covered in them. Further, each report includes an Action Plan based on Recommendations: enlisting Recommendations, Proposed Actions, Anticipated Value Addition and Responsible Department for taking action.

A combined Action Plan based on all such recommendations including associated estimated cost is presented as follows:

Action Plan based on Recommendations

S. No.	Recommendations	Proposed Actions	Estimated Cost, Million Rs. (at 2010 price level)
A.	**Hydro-meteorological Aspects**		
1	Installation of new Rain - Gauge stations	It is proposed to install 103 nos. new Rain Gauge stations, and upgrade/rehabilitate 13 nos. existing Rain Gauge stations. Out of 103 nos. new Rain Gauge stations (8+21) 29 nos. are self-recording and 74 nos. are Non-self recoding. 13 nos. existing Rain Gauge stations are also self-recording, which are proposed for upgradation or rehabilitation.	16.14
2	Installation of new Dam Observation Stations	It is proposed to install water level recorders at 83 dams and canals, covering 12 river basins. On dams two types of water level recorder (WLR), i.e. Shaft Encoder type and Bubbler type WLRs are proposed. At each location Automatic Weather Station (AWS) is also proposed.	87.18
3	Installation of new River Gauge & Discharge (G&D) sites	It is proposed to install 53 (19 + 34) new River Gauge & Discharge (G&D) sites in various basins/sub-basins. Out of the 34 new sites proposed, 21 sites can be taken up on first priority, than another 10 sites on second priority and remaining 3 sites on third priority.	28.49
4	Improvement in existing River Gauge & Discharge (G&D) sites	Considering the present status of existing River Gauge & Discharge sites, various actions are proposed to improve the existing condition of site like update the cross-section data, replacement of instruments, etc.	3.27
5	Suitability of new G&D site location	The tentative locations of new G&D sites have been given, however, following points may be kept in mind before selecting the location: • The cross section of the stream needs to be fixed and known. When the system is installed e.g. under a bridge (having fixed concrete side walls), it is easy to calculate the cross section for different water levels. Therefore installation near or on/under such a fixed structure (bridge, lock, etc.) has great advantages. • The section of the river/stream where measurements are to take place should be preferably straight approximately 50 m before the measuring point (this to make the flow as uniform as possible). • There should be no major boulders or large objects upstream of measurement location (same reason as above). • There should be no aquatic growth at the measurement location. • The stream should not overflow its banks for any water level. • The stream section should not be too wide because for a very wide section we could only measure the highest flows. The river cross-section at gauging site should be stable. • Protected site; when the location where the system is protected against theft or damage (by people or	-

S. No.	Recommendations	Proposed Actions	Estimated Cost, Million Rs. (at 2010 price level)
		animals) this is preferred.	
6	Data measurement and storage	The following is proposed for proper data management and storage: • River cross-sections details where G&D site is installed should be measured and updated atleast once in 5 years. This will reduce the error in measuring the stream flow to a large extent. • Discharge rating curve should be generated/updated for all gauging sites to assess the volume of water passed through a particular site. • All defunct and faulty instruments may be either replaced or upgraded. • Measurements may be taken at regular interval and stored in standardized digital data formats. This data be digitized, quality checked and stored in electronic form at a central place. • If an existing gauge site has unstable cross-section it may be shifted to nearby location with stable cross-section.	-
Sub-Total			**135.08**
B. Existing Major and Medium Projects			
1	Monitoring of Project catchments	• The WHS should only be constructed in catchments of existing projects where the yield is surplus, that too after considering its effect on downstream dam. • The encroachments on river beds should be checked. • Any sort of development in the catchment should be monitored and checked such as illegal groundwater extraction, change in cropping intensity, number of additional WHS constructed, etc.	-
2	Proper recording of Reservoir operation data	• Reservoir operation data like date of release of water, its quantity etc should be monitored and data should be securitized and stored electronically for easy access and use. • Volume of water spilled should be properly measured. • There should be a mechanism to accurately measure inflow to the dams by proper water accounting or by installing a discharge site. A standardized format should be developed to keep record of all water balance components (inflow, releases, spills, evaporation etc.) at reservoir as it is monitored and stored in projects like Jakham Dam, Kota Barrage, Jawahar Sagar Dam etc. • Evaporation at each reservoir site should be measured by installing Evaporation pan. • Gauge-Capacity curve for the reservoir should be updated.	-
Sub-Total			**-**

S. No.	Recommendations	Proposed Actions	Estimated Cost, Million Rs. (at 2010 price level)
C. Groundwater			
1	Monitor groundwater levels, groundwater quality and groundwater development in the State	• Observe the groundwater levels and groundwater quality on regular basis (4 times in a year) with groundwater monitoring network and study their trend. • The assessment to monitor the ground water development and use is done at an interval of 4 years. It would be desirable if assessments are also made regularly on annual basis also for controlled use of annually available groundwater.	-
2	Improve the database of specific yield for the benefit of refining estimates of dynamic groundwater recharge	Execute a field survey for conducting pumping tests on wells in each district. Also to conduct pumping tests on every new piezometer being installed.	-
3	Examine additional methods for evaluating groundwater recharge	Chloride mass balance and Chlorine-36 isotope methods for estimating long-term average rates of deep percolation may be experimented as alternative method. A two year study to test applicability of two methods at two different sites may be desirable. Such methods are ideal for arid and desert areas.	
4	Improvement of Groundwater monitoring network	• Additional 2745 monitoring wells should be installed and the existing 1351 duplicate ones or very close ones should be closed based on the recommendations of the optimization study of groundwater monitoring network in the report. • Out of the existing 3518 dug wells considered under optimization study, 827 are proposed to be excluded from groundwater monitoring network, hence there is a need to replace the remaining 2691 dug well monitoring stations with piezometers. • As per the water table decline trend, 128, 124 and 44 piezometers are likely to go dry in 2020, 2040 and 2060, which shall need replacement in future.	823.50 807.30
5	Monitor the presence of pesticides in the groundwater in areas of intensive agriculture/command areas activity, especially in locations faced with problems of high nitrate levels	• Undertake well planned/designed studies towards assessment of non-point source contamination of alluvial aquifer systems to begin with in areas where increasing trends of nitrate levels are observed. Setting up key monitoring wells exclusively for monitoring and surveillance of pesticides in groundwater, as well as monitoring the increasing trends of nitrates and fluoride level in groundwater of various aquifers. • Design specific studies to determine the effects of land uses on groundwater quality. Suggested sites can include: (a) Urban storm water disposal and the other (b) Over cultivation areas associated with application of fertilizers and pesticides.	-
6	Conduct new exploratory drilling	• Exploratory drilling in the recommended areas/locations • Exploratory drilling of deep aquifers	48.50

S. No.	Recommendations	Proposed Actions	Estimated Cost, Million Rs. (at 2010 price level)
		• Pumping test should be made mandatory for every newly drilled well in the State	
7	Outflow of groundwater resources	Conservation / exploitation of groundwater flowing to adjoining country.	-
8	Restructuring and capacity building of Groundwater Department	• Conduct study on restructuring and capacity building of Groundwater Department, involving institutional capacity building, infrastructure capacity building and professional capacity building. • Creation of GIS Cell • Creation of Recharge Cell • Creation of Legal Cell	-
9	Better understanding, higher awareness and sustainable development of the groundwater resources by the farmers	Develop outreach and translate the dynamics of groundwater to farmers, group of farmers & WUAs to create understanding, awareness and sustainable development of the groundwater resources.	-
10	Adopt on-farm water management (OFWM) practices	State should make use of Resource Conservation Technologies such as laser land leveling, ditch and furrow methods of irrigation using tensiometer for affecting crop-water use, on-farm pond development including crop-diversification through micro-irrigation based system particularly in over-exploited and critical blocks with a view to developing water use efficiencies.	-
11	Control on illegal drilling of wells and control on groundwater exploitation	• Registration of rigs to control illegal drilling of wells. • To frame a Groundwater Act to control the exploitation of groundwater.	-
12	Data upgradation	Creation of an online system of various groundwater data entry at district level linked with the GIS Cell for an upgraded and updated data bank.	-
13	Improve, detailed and frequent monitoring of stressed aquifer systems	• Set-up key observation-wells in stressed aquifers where stage of ground water abstraction is much higher than dynamic annual groundwater availability. • Installation of 1197 digital automatic water level recorder as well as water quality monitoring system in a phased manner to enable obtaining continuous & real- time record of levels and water quality. • At least 5 key wells need to be installed on each of the 19 mapped major aquifer units in the state, to begin with.	179.55
14	Promote Resource Conservation and Managed Aquifer Recharging measures towards improving water availability	• The proposed Recharge Cell under RGWD as one of its wing to discharge intended recharging work/ operation on continuing basis. • Designating ground water conservation areas (GCAs) in over- stressed aquifers where area-specific and design specific recharging measures be employed keeping in view the climatic- geomorphological and topographic set-up • Percolation ponds with recharge shafts	-

S. No.	Recommendations	Proposed Actions	Estimated Cost, Million Rs. (at 2010 price level)
		• Recharging ephemeral stream bed areas through construction of cascading barriers and check dams • Promoting and upscaling farmers dug well recharge programme as well as arresting run-off at Aravalli Ridge-toe areas through specially dug lengthy stretches of trenches back-filled with boulders & gravels • Recharge shafts and roof top rain water harvesting measures to augment local ground water in Urban and Institutional areas. • Managed Aquifer Recharge programme may take benefit and develop convergence with Revised Master Plan for Recharging Ground Water (2013) prepared by CGWB, in which the areas feasible for recharge and types of structures to be constructed are given for consideration and implementation by State Government of Rajasthan	
15	Reduction of groundwater demand in over-exploited areas	Use of modern irrigation practices and technologies (pressurized irrigation) to reduce groundwater extraction for which subsidies are provided by GoR and irrigation during hours of low potential evaporation.	-
16	Use of Fresh Static resources as contingency measures only	• Static resource (fresh) should not be mined but used only as contingency measures to be pressed into service and use only during drought periods • It is suggested if some groundwater sanctuary High Production wells could be constructed as regimes for supply in periods of distress & dire scarcity to serve as "Groundwater Sanctuary Parks"	-
17	Improve Quality of water supply to villages having non-potable water and link them to surface water schemes	A time based priority program to provide safe-drinking water based on principles of scientific source locations and well construction in convergence with Ministry of Drinking Water and Supply, Government of India, shall help improve the health and hygiene status of people inhabiting such areas.	-
18	Utilization of saline groundwater	• Drinking water stations for livestock should be raised based on tube well water supply from marginally saline groundwater resource areas. • Desalination and appropriate use of brackish water can be considered with donor assistance under bilateral corporation programme • Conduct experiments for developing use of brackish/saline groundwater for raising salt-tolerant crops where huge quantities of saline groundwater resides in shallow and deep aquifer systems	-
19	Execute a programme on Repair, Renovation and Restoration of all village ponds & tanks	To be taken up on a time-bound programme which may have convergence with MNREGA and RKVY Scheme of Ministry of Agriculture, Government of India including desilting of ponds and or constructing recharge shafts around such ponds particularly at intake points to help recharge groundwater locally.	-
20	Utilization of urban storm water	Arresting of Urban run-off and its use for horticulture, other non-drinking water uses and groundwater recharge is proposed based on "Modular Rain Water Tank Technology" which can capture huge quantity of Urban-run-off/ highway- run-off.	-
Sub-Total			**1,858.85**

S. No.	Recommendations	Proposed Actions	Estimated Cost, Million Rs. (at 2010 price level)
D.	**Water Pollution**		
1	Reduce Domestic Pollution in Urban and Rural areas	Urban • Establishment of sewage collection and treatment facilities in all the Class-I cities and Class-II towns, and subsequently in the lower category of the towns in the State, with adequate resources available for effective O&M • New Residential Developments to have their own fully functional sewage treatment systems and recycling and reuse systems • Building byelaws to be amended and made mandatory for new townships, flat schemes, colonies for opting dual piping system for flushing from treated wastewater • Watering of parks and gardens should be done by treated sewage water and surplus, if any, to be used for irrigation • Development of guidelines and regulation for septage management Rural • Sanitation in rural areas to prevent pollution of small waterbodies, Tubewell, Handpumps, etc.	14,010.0 (for 2010) + 4,870.00 (additional for 2020) + 7,810.00 (additional for 2040) + 5,480.00 (additional for 2060)
2	Reduce Industrial Pollution	• Establishment of Effluent collection and treatment facilities in all large and medium industries and CETPs for clusters of small scale industries in the State, with adequate resources available for effective O&M Large Scale Industries • Concept of '0' outflow should be strictly followed • Treatment of effluent should be mandatory • Recycling of treated effluent Small Scale Industries • All the small scale industries in clusters to be shifted to identified industrial areas • All the small scale industries in residential areas to be shifted to identified industrial areas • All such industries should be connected to Common Effluent Treatment Plants	-
3	Reduce Pollution from Non-point Sources	• Establishment of adequate and effective toilets for urban / rural poor • Establishment of effective garbage collection, transport, treatment and disposal facilities in all the	-

S. No.	Recommendations	Proposed Actions	Estimated Cost, Million Rs. (at 2010 price level)
		Class-I cities and Class-II towns, and subsequently in the lower category of the towns in the State, with adequate resources available for effective O&M • Effective biomedical wastes and hazardous waste collection and disposal • Reduce agriculture pollution from Fertilizers/ Pesticides • Promotion of Organic Farming	
4	Ensure Clean Water in the rivers and their Tributaries	• Establish a network of water quality monitoring • Establish online monitoring on important rivers	-
5	Ensure environmental flows in the rivers, their tributaries and lakes/wetlands	Water resources augmentation in the different rivers and lakes/wetlands including various measures of water conservation in agriculture, domestic and industrial use, rainwater harvesting, reuse of wastewater	-
6	Ensure ecological integrity of the rivers, their tributaries and lakes/wetlands	Establish a sound scientific network of ecological assessment of rivers and lakes/wetlands health in the State including structural and functional components of ecosystem	-
7	Monitoring of Water Pollution and functioning of various treatment systems	• Regular monitoring of compliance of norms • Vigilance monitoring of compliance of norms	-
Sub-Total			**32,170.00**
E. Improvement Plans			
1	Rehabilitation of 25 Major / Medium Irrigation Projects listed below: Arwar, Bassi, Bilas, Chandrabhaga, Chandsain, Dheel, Dindoli, Dugari, Galwania, Jaisamand (Udaipur), Jakham, Kalisil, Khari, Kothari, Lassadia, Madhosagar, Mahi Bajaj Sagar, Mataji Ka Khera, Meja, Murlia, Rajsamand, Sardar Samand, Ummed Sagar, Vallabhnagar, Wagan	Preparation of Detailed Project Reports for Rehabilitation of the listed 25 Major / Medium projects on priority.	2,867.39
2	Improvement in Reservoir operation database and measurement of evaporation losses.	Regular records of storages, water drawls for irrigation, crop grown in command areas, evaporation, seepage losses and spillage should be kept. In all the projects losses through evaporation should be measured regularly.	-
3	Reservoirs should be resurveyed to assure	The elevation-area-capacity curves of reservoirs are not updated and may give wrong information on	-

S. No.	Recommendations	Proposed Actions	Estimated Cost, Million Rs. (at 2010 price level)
	latest area-capacity at various levels in order to consider the impact of siltation in reservoirs.	water availability, hence the reservoirs for Major / Medium dams should be resurveyed through latest techniques (like sonar survey) and the updated elevation-area-capacity curves / tables should be prepared and in future should be updated periodically.	
4	Formation of Water Users Associations.	WUAs (Water Users Associations) should be formed in all projects and encouraged to be actively involved in water allocation and distribution as well as proper outlets should be designed in order to ensure equity in respect of head, middle and tail reaches.	-
5	Promotion of Night irrigation to reduce field losses through evaporation	Night irrigation should be promoted to assure saving on operational loses below the outlets and improve upon field efficiency.	-
6	Lining of field channels	Lining of field channels through WUAs. If conversion to pressurized irrigation is opted then lining of field channels is not required.	-
7	Conjunctive use of water	Conjunctive use of water especially in command areas where water logging is observed and likely to occur. Also pressurized irrigation should be promoted in such areas.	-
8	Adoption of modern irrigation techniques	Looking at the scarcity of water and reduced inflows to dams, it is recommended to adopt modern irrigation techniques i.e. conversion from flood irrigation to pressurized irrigation in existing as well as new projects and also in groundwater irrigated areas to control over-exploitation. For surface water irrigated areas, conversion from flood irrigation to pressurized irrigation will result in increase in irrigated area. However, the areas irrigated by groundwater should not be increased, so that it will reduce the groundwater pumping and will stabilize the ground water levels in long term. GoR is also promoting pressurized irrigation and providing subsidy for it. A combined subsidy of 50% is provided by the Central and State Governments (Central: 40%, State: 10%) for sprinkler and drip irrigation systems. The Government of Rajasthan has taken an initiative to provide 20% additional subsidy for drip irrigation system.	-
Sub-Total			**2,867.39**
F. Development Plans			
1	Implementation of proposed projects.	• Preparation of Detailed Project Reports (DPR) of the 33 proposed projects. The proposed projects include Major/ Medium/ Minor storage projects, inter-basin transfer projects and artificial recharge projects. Also, most of the proposed projects consider component of drinking water demand of nearby town and villages. • Implementation of these proposed projects after approval of respective DPRs.	125,212.60
2	Catchment Treatment to reduce	The life span of a reservoir is greatly reduced due to erosion in the catchment area. Adequate preventive	-

S. No.	Recommendations	Proposed Actions	Estimated Cost, Million Rs. (at 2010 price level)
	sedimentation of reservoirs and increase inflows	measures are thus needed for the treatment of catchment of reservoirs for its stabilization against future erosion including proper cross-drainage etc.	
3	Watershed Development	Integrated use, regulation and development of water and land resources of each watershed with emphasis on soil and water conservation.	-
4	Holistic approach in water resources planning and management	At present, there is no holistic approach and each department of Rajasthan is working without taking into account concern of other relevant department on various water related issues. There should be one department for planning i.e. SWRPD. Restructuring of SWRPD and RGWD is a must to meet the future challenges, which is necessary to implement state water policy action plan, community participation, proper data collection, enforcing legal issues, etc.	-
Sub-Total			**125,212.60**
G. Specific Plans/Projects to Fill Gaps (Some projects common with Development Plans)			
1	Supplement inflow to Bisalpur Dam	Study various options of supplementing inflow to Bisalpur Dam from Mahi and Chambal rivers, preparation of Detailed Project Reports and Implementation of selected option.	-
2	Supplement inflow to Jaisamand Dam (Alwar)	Study various options of supplementing inflow to Jaisamand Dam (Alwar) from Chambal river, preparation of Detailed Project Reports and Implementation of selected option.	-
3	Supplement inflow to Jaisamand Dam (Udaipur)	Study various options of supplementing inflow to Jaisamand Dam (Udaipur) from Anas river and Jakham Dam, preparation of Detailed Project Reports and Implementation of selected option.	-
4	Supplement inflow to Rajsamand Dam (Rajsamand)	Study various options of supplementing inflow to Rajsamand Dam (Rajsamand) from Anas river, preparation of Detailed Project Reports and Implementation of selected option.	-
5	Supplement inflow to Meja Dam (Bhilwara)	Study various options of supplementing inflow to Meja Dam (Bhilwara) from Anas river, preparation of Detailed Project Reports and Implementation of selected option.	-
6	Supplement inflow to Ramgarh Dam (Jaipur)	Study various options of supplementing inflow to Ramgarh Dam (Jaipur) from Mej river, preparation of Detailed Project Reports and Implementation of selected option.	-
7	Construction of Isarda Dam	Preparation of Detailed Project Report for construction of Isarda Dam including its water availability.	-
8	Construction of Kalisindh Dam Phase II	Further necessary action for construction of Kalisindh Dam Stage II.	-
9	Construction of proposed Parwan Major Irrigation Project	Preparation of Detailed Project Report for construction of Parwan Major Irrigation Project including its water availability.	-
10	Construction of Dewas Stage III and IV	Preparation of Detailed Project Report for construction of Dewas Stage III and IV and diversion of water to lakes of Udaipur city.	5,681.50
11	Timely completion of ongoing water supply	1. Barmer Lift Canal Water Supply Project Phase I (Source of water: IGNP)	6,886.60

S. No.	Recommendations	Proposed Actions	Estimated Cost, Million Rs. (at 2010 price level)
	projects	2. Pokaran Phalsoond Balotra Lift Water Supply Project (Source of water: IGNP)	14,442.00
		3. Chambal-Dhaulpur-Bharatpur Water Supply Project (Source of water: Chambal River)	4,779.90
		4. Chambal Bhilwara Water Supply Project (Source of water: Chambal River)	7,278.20
		5. Chambal-Sawai Madhopur-Nadoti Water Supply Project (Source of water: Chambal River)	4,681.80
		6. Nagaur Lift Water Supply Project (Source of water: IGNP)	7,610.00
		7. Jawai-Pali pipeline project (Source of water: Jawai Dam)	6,347.90
		8. Water supply to Keoladeo National Park (Source of water: Goverdhan Drain)	560.40
12	Implementation of some proposed drinking water supply projects on priority	9. Barmer Lift Project Phase II (Source of water: IGNP)	7,977.50
		10. Aapni Yojana Phase II (Source of water: IGNP)	13,300.00
		11. Fatehpur-Laxmangarh Project (Source of water: IGNP) Note: This project should also include supply to Sikar town and villages of Piprali block of Sikar district	8,320.00
13	Reduction in distribution losses of piped drinking water supply schemes	Rehabilitation of piped drinking water supply distribution system considering the following studies: 1) Benchmarking of Urban water supply schemes of Rajasthan (by SMEC) 2) Benchmarking of Rural water supply schemes of Rajasthan (by Ramky Enviro Engineers Ltd.)	-
14	Review of Inter-State matters	Inter-State agreements of Rajasthan with Gujarat, Haryana and Punjab should be reviewed for additional utilization of water from outside Rajasthan.	-
15	Catchment Treatment to reduce sedimentation of reservoirs	The life span of a reservoir is greatly reduced due to erosion and other development like construction of roads etc. in the catchment area. Adequate preventive measures are thus needed for the treatment of catchment of reservoirs for its stabilization against future erosion and proper cross-drainage.	-
16	Utilization of water stored in abandoned mine-pits	There is a lot of water stored in abandoned mine-pits in Rajasthan. Further studies on feasibility of its utilization should be carried out.	-
17	Utilization of National Highway and State Highway storm-runoff	Study on feasibility of utilization of National Highway and State Highway storm-runoff by diverting it to nearby areas/waterbodies should be carried out.	-

S. No.	Recommendations	Proposed Actions	Estimated Cost, Million Rs. (at 2010 price level)
18	Utilization of treated brackish groundwater	Treated brackish groundwater of Matasukh mines is being supplied to villages of Jayal Block of Nagaur District. Similar options should be studied in future.	-
19	Utilization of Ghaggar flood water	Study on feasibility of harvesting of Ghaggar flood water draining to Pakistan and its use for augmenting groundwater resources should be carried out.	-
20	Utilization of surplus imported water during rainy season	Study on feasibility of utilization of surplus water in IGNP, Bhakra and Gang Canal System during rainy season, if any, for artificial recharge.	-
21	Master Plan for Artificial Groundwater Recharge	Master Plan for artificial recharge through available surplus internal surface water and imported canal water should be prepared since more than 60% of the irrigated area is through groundwater, which is facing significantly declining water levels.	-
22	Artificial Groundwater Recharge and Waste Water Reuse in Urban Areas	Study on "Artificial Groundwater Recharge and Waste Water Reuse for Jaipur City" was carried out by ANTEA International of France. Similar studies/work should be carried out for other big cities of Rajasthan. Follow up of all such studies to be done by respective departments.	-
23	Follow up of recent studies carried out in Rajasthan related to water sector	Follow up of Groundwater study and related software developed by ROLTA and Study on Benchmarking of Irrigation Projects by WAPCOS and any other study related to water sector.	-
24	Impact assessment of new structures	For any new structures, anicut etc. the impact assessment for downstream water bodies to be mandatorily worked out.	-
25	Investigations and Studies to find out reasons for reduced inflow to Pushkar Lake and other similar cases	Further investigations and studies should be carried out to find out the reasons for reduced inflows to Pushkar Lake and other similar cases and accordingly preventive measures should be taken.	-
26	Reduction in evaporation losses from small water harvesting structures	In order to reduce evaporation losses from small rain water harvesting structures, the water should be lifted after the month of March and stored in tankas to meet the drinking water requirement during summer or construct recharge shaft to recharge groundwater and ensure that water recharges by March: as the evaporation is about 50-60% of annual evaporation during the summer months.	-
27	Holistic approach in water resources planning and management	At present, there is no holistic approach and each department of Rajasthan is working without taking into account concern of other relevant department on various water related issues. There should be one department for planning i.e. SWRPD. Restructuring of SWRPD and RGWD is a must to meet the future challenges, which is necessary to implement state water policy action plan, community participation, proper data collection, enforcing legal issues, etc.	-
Sub-Total			**87,865.60**
Total			**250,109.52**

1. Introduction

1.1 Background

The State Water Policy of Government of Rajasthan, February 2010, provides for development of its Water Resources in a well planned way. All new projects shall be planned based on micro watershed planning basis so as to ensure equity in use of surplus water. It is on this account that the state Government of Rajasthan took up study to review and update all river Basin Master plans for the integrated development and Management of all its water resources. In this connection necessary provision of funds were made in EC funded State Partnership Program (SPP) under implementation in Rajasthan State.

The earlier comprehensive study on water planning for different river basins in Rajasthan State was carried out by TAHAL-WAPCOS Consultants during year 1994-1998. This water resources planning study report contains the data, methodology and results of the analysis done for each river basin.

The above study was considered quite old and had much reduced relevance in today's context. Since year 1998 there are vast changes. National and State water policies are in place. Actual ground level water requirement for different purposes has changed. There is much change in land use and land cover. Cropping pattern is much different. Agricultural practices have improved. Existing infrastructure for water storage/ water diversion has developed almost fully in some basins. There is also change in water availability due to surface water and ground water interface and effect of excessive use of ground water, surface water conservation and its effect due to change in evaporation and seepage losses. Water quality today plays a dominant role. Environmental aspects can no longer be ignored. The report was also based on many assumptions in respect vital data where otherwise accurate observed data was required. Subsequent policy decisions, enhanced infrastructures, and efficient water use practices as envisaged are bound to have tremendous effect on present day planning process.

The present study therefore envisages to take-up review and fresh planning of all the water resources of Rajasthan based on updated water resources data and modern techniques now available in this field of study encompassing all necessary provisions made in the new water policy of the state Government. The study would require long term planning, considering a number of probable scenarios founded on imaginative thinking and backed with necessary experience in the field of water resources planning. Alternative measures like recharging of ground water aquifers, inter-basin transfers, recycling and long-term annual carry-over reserves in aquifers may be thought of as long term solutions.

1.2 Project Objectives

The objectives and tasks of the present study on Planning of Water Resources of Rajasthan State were specified in the Terms of Reference (ToR) which form part of the contract (Agreement No.: 2/2010-11) between the Consultants and the Government of Rajasthan (GoR), State Water Resources Planning Department (SWRPD), signed on 16th December 2010.

1.2.1 Purpose

The purpose of this assignment is to prepare a long term plan and policy for development and management of the water resources of the State of Rajasthan, both surface (internal and external) and ground water, on comprehensive and integrated basis. The period of planning envisaged is 2010-2060.

1.2.2 Scope of Work

1. Data Collection
    - Collection of reference documents, reports, Government orders etc.
    - Study and review of relevant previous reports (such as Tahal & WAPCOS report).
    - Reconnaissance of all the basin areas.
    - Collection of all the hydrological, hydro-meteorological, hydro-geological, pedestal maps/data/information/ complete details of existing and ongoing water resources projects/crop water requirement/water quality/and other data required in water resources planning.
    - Identification of Agroclimatic zones in the State.
    - Inventory of existing & ongoing projects
2. Analysis of Agroclimatic zone wise hydrology, temperature over a period of 20 years, find all changes in precipitation, no. of rainy days, rainfall intensity temperature, humidity and the impact on water resources, cropping pattern and productivity and suggest futuristic strategies for water uses, cropping pattern, in view of the changes.
3. Study the basin wise / sub-basin wise water availability (at various dependabilities) both surface and ground water (including interstate share of Rajasthan from Ravi, Beas, Satluj, Chambal, Mahi and Yamuna Water, indicate changes as compared to the earlier WAPCOS – Tahal Study with reasons for change.
4. Carry out detailed study of the catchment areas of all major, medium and minor irrigation projects, identify the WHSs constructed & the watershed works carried out & mark the same on GIS mapping with requisite hydrological details & assess their impact on water flows to the project, study the transevaporation of these small water bodies & resultant water loss, their impact on ground water recharging and suggest a future policy for construction of such structures in the catchment area.
5. Agroclimatic zone wise ground water basins studies, delineation of aquifers on microshed basis, marking them on the GIS mapping Panchayat Samiti wise & village wise, based on the present exploitation & recharging of aquifers compute the remaining life of the aquifer so that this information could be disseminated Panchayat Samiti & Village wise.
6. Estimate the quantity of Water Pollution (Rivers, Industrial Municipal etc.) source wise, District wise and indicate costs of reclamation / treatment and possible uses.
7. Prepare Districtwise & Blockwise plans of supply & demand of water for various uses, crops, strategies to fill gap and estimated costs.

8. Identification of new projects in water surplus basins based on scientific study & survey & based on socio economic viability criteria.
9. Identification of projects for Rehabilitation and/ or modernisation for existing major and medium projects based on socio economic viability criteria.
10. Preparation of comprehensive full scale integrated water resources plan for the State as a whole.
11. Imparting training to the staff and officers of SWRPD & WRD on planning and on use of software used in the study.

1.2.3 Reporting Requirement

S. No.	Stage	Name of the Report
1	First	Inception Report
2	Second	Preliminary Reports i) Report on Agroclimatic zone wise hydrology and weather, as per Para 2 of Scope of Work
		ii) Report on basin wise / sub basin wise surface and ground water availability, as per Para 3 of Scope of Work
		iii) Report on detailed study on catchment area, as per Para 4 of Scope of Work
		iv) Report on Agroclimate zone wise ground water study, as per Para 5 of Scope of Work
		v) Report on Water Pollution, as per Para 6 of Scope of Work
		vi) Report on District wise Plan of supply & demand of water, as per Para 7 of Scope of Work
		vii) Report on Identification of new projects in water surplus basin, as per Para 8 of Scope of Work
3	Third	Draft Final Reports i) Report on Agroclimatic zone wise hydrology and weather, as per Para 2 of Scope of Work
		ii) Report on basin wise / sub basin wise surface and ground water availability, as per Para 3 of Scope of Work
		iii) Report on detailed study on catchment area, as per Para 4 of Scope of Work
		iv) Report on Agroclimate zone wise ground water study, as per Para 5 of Scope of Work
		v) Report on Water Pollution, as per Para 6 of Scope of Work
		vi) Report on District wise Plan of supply & demand of water, as per Para 7 of Scope of Work
		vii) Report on Identification of new projects in water surplus basin, as per Para 8 of Scope of Work
		viii) Report on Identification of Projects to be rehabilitated, as per Para 9 of Scope of Work
4	Fourth	Final Reports i) Report on Agroclimatic zone wise hydrology and weather report, as per Para 2 of Scope of Work
		ii) Report on basin wise / sub basin wise surface and ground water availability, as per Para 3 of Scope of Work
		iii) Report on detailed study on catchment area, as per Para 4 of Scope of Work
		iv) Report on Agroclimate zone wise ground water study, as per Para

S. No.	Stage	Name of the Report
		5 of Scope of Work
		v) Report on Water Pollution, as per Para 6 of Scope of Work
		vi) Report on District wise Plan of supply & demand of water, as per Para 7 of Scope of Work
		vii) Report on Identification of new projects in water surplus basin, as per Para 8 of Scope of Work
		viii) Report on Identification of Projects to be rehabilitated, as per Para 9 of Scope of Work
		ix) Report on comprehensive full scale integrated plan for the State as a whole, as per Para 10 of Scope of Work
5	Fifth	Training to Staff, as per Para 11 of Scope of Work
6	Sixth	20 hard copies and 100 soft copies of all Final Reports

1.3 Review of Earlier Studies

During the beginning of this study the consultant reviewed earlier studies, abstract of which are presented in Appendix 1.

1.4 This Report

This report on Integrated State Water Resources Plan is the last one in the series of nine Final Reports. The objective of this report is to present a comprehensive full scale integrated plan for the State as a whole as well as to summarize the various aspects covered under other reports of this study on Planning of Water Resources of Rajasthan and their conclusions and recommendations in form of an Action Plan highlighting responsible agencies for execution of the plans.

This report also discusses policies and regulations in context of water resources and water supply planning, management, regulation and improvement and specific issues related to environment and water pollution.

1.5 General Approach and Methodology

At the start of the project the Consultant presented its refined Approach and Methodology to carry out various aspects of this study in the Inception Report. At the Preliminary Report Stage in each Preliminary Report a sample study of the related aspects were presented for acceptance and approval by the Review Committee members. Further, based on the approved approach and methodology of the sample study each Draft Final Report presented the related aspects for the complete study area with desired level of detailing as per Terms of Reference (ToR) which were further scrutinized by the Review Committee members. Following this scrutinization and guidance at Draft Final Stage on further refinement, each Final Report has been prepared which is again accepted and approved by the Review Committee members.

A detailed description of approach and methodology employed by the Consultants to carry out each aspect of the study is presented in each Final Report.

In general the approach has been as follows for each task:

- identify the task
- identify data requirement and accordingly carry out data collection
- data quality checks
- carry out the detailed analysis as per requirement of task fulfilling the ToR requirement
- draw conclusions from the analysis and give recommendations alongwith estimated costs, if applicable

The methodology adopted has been specific to each task and described in detail in each Final Report. The Consultants have adopted the latest computer models in the field of water resources planning to carry out this assignment. Geographical Information System (GIS) has been extensively used in the study for superimposition of different area units, to carry out spatial analysis, to publish high quality maps, etc.

1.6 Data Availability and Reliability

A large volume of data has been collected from different State and Central organizations and other agencies such as:

- State Water Resources Planning Department (SWRPD)
- Water Resources Department (WRD), Rajasthan
- Rajasthan Ground Water Department (RGWD)
- Public Health Engineering Department (PHED), Rajasthan
- Directorate of Agriculture, Rajasthan
- Rajasthan State Pollution Control Board (RSPCB)
- Directorate of Economics and Statistics, Rajasthan
- Animal Husbandry Department, Rajasthan
- Forest Department, Rajasthan
- Rajasthan State Industrial Development and Investment Corporation (RIICO)
- Department of Industries, Rajasthan
- Rajasthan Rajya Vidyut Utpadan Nigam Ltd. (RVUNL)
- State Remote Sensing Application Centre (SRSAC), Jodhpur
- Central Water Commission (CWC)
- India Meteorological Department (IMD)
- Central Ground Water Board (CGWB)
- Central Pollution Control Board (CPCB)
- Geological Survey of India (GSI)
- Census of India
- National Remote Sensing Centre (NRSC), Hyderabad

Further, various consistency checks and quality checks were made on the data collected, wherever applicable and it was tried to validate the data. It is important to note the difficulties and constraints that were encountered in the course of data collection and validation, which are as follows:

- Some of the past-years data are recorded and maintained on hard copies, which may have human error elements while recording the values.
- Poor maintenance of stations and instruments.
- Missing continuous time series data.
- Incorrect and ambiguous records in the series, due to faulty instruments and/or human error.
- Values, writing records, interpolation of data, as well as unrecorded data in the series.
- Some digitized maps like basin boundaries had to be corrected by the Consultants using the Shuttle Radar Topography Mission (SRTM) 90 m Digital Elevation Model (DEM) data.

2. Terrestrial Elements

2.1 Physiography

Rajasthan is the largest state in the Indian Union, with an area of 342,264 km^2. It is located in northwest India between longitudes 69°29' and 78°17' East and latitudes 23°30' and 30°11' North. The Tropic of Cancer passes through Rajasthan south of Banswara town.

Rajasthan has a horizontal diagonal length of 869 km, from west to east, and a vertical diagonal length of 826 km, from north to south. Its western boundary extends for 1070 km along the international India-Pakistan border. In the north it is surrounded by Punjab and Haryana States, to its east lies Uttar Pradesh State, Madhya Pradesh - in the southeast and Gujarat in the south and southwest.

Rajasthan features a variety of landforms, which have resulted from erosional and depositional processes over a long geological time period. Four major physiographic divisions have been identified in the state:

- Aravalli Hill Ranges,
- Eastern Plains,
- The Thar Desert ,and
- The South Eastern Plateau.

Elevations of the Aravalli hills range from 450 m to 900 m above mean sea level (amsl). The Aravallis are aligned northeast to southwest and are the major water divide, separating the State into two hydrologically different entities in the east and in the west. The eastern part is characterised by high rainfall and well defined drainage systems. The land elevation of the eastern part varies from 150 m to 450 m amsl. This part of Rajasthan covers most of Alwar, Bharatpur, Jaipur, Tonk, Sawai Madhopur, Karauli, Bundi and Kota districts.

Land elevations in the western part of the State vary from 30 m to over 300 m amsl and is characterised by arid land forms. The area is covered by aeolian, alluvial and buried channels, sand dunes and inter-dunal plains. Small to medium-sized saline water depressions also occur in the western parts of the State. These depressions are responsible for the occurrence of evaporite deposits in the western part of Rajasthan that have great influence on groundwater quality.

The western part of Rajasthan is mainly covered by the Thar Desert and can be divided into four different physiographic units as follows:

- Sand dune areas covering parts of Jaisalmer, Barmer, Bikaner and western parts of Jodhpur and Churu districts;
- The Luni-Jawai plain, covered by parts of Jodhpur, Pali, Jalore, Sirohi and the southern parts of Nagaur districts;
- Shekhawati tract with sandy plain and low sand dunes, covered by parts of Jhunjhunu, Sikar, Churu and also northern part of Nagaur district.

- Lower Ghaggar river basin, covering Ganganagar and Hanumangarh districts, which is relatively a flat land with a remnant channel of Ghaggar river, probably a tributary of the defunct mighty Saraswati River.

The south-eastern plateau area of Rajasthan consists of two plateaus, the Hadauti plateau, which covers parts of the districts of Jhalawar, Baran and Kota where the Vindhyans are intruded by volcanic rocks, and the Malwa plateau, which extends into the southern parts of Chittaurgarh, Pratapgarh and Banswara districts.

2.2 Drainage

The topography, rainfall, and geology are the most important factors affecting the extent and orientation of drainage, in Rajasthan in general and within a basin in particular. The Water Resources Department of Rajasthan has delineated 16 River Basins in the State, and some of the major drainage basins have been further divided into sub-basins.

The part of Rajasthan extending west of the Aravalli hills range, called Outside Basin, has no distinct catchment areas. The Outside (Undefined) Basin comprises a total area of 1,30,522 km^2. The upper part of this area receives Ghaggar floodwaters originating in the upper and middle parts of Ghaggar river basin in Himachal Pradesh, Punjab and Haryana.

Shekhawati rivers flows mostly in Sambhar lake or in northwards direction and vanishes in sand dunes. Ruparail, Banganga, Sabi flows in eastern direction and from part of Yamuna basin. Parbati river flows in eastern direction and outfalls in Gambhir river which outfalls in Yamuna river. Banas river is a tributary of Chambal, which in turn is a tributary of river Yamuna (part of Ganga system). The Luni is a southwest-flowing inland river basin. The Luni plain is located in the districts of Jodhpur, Pali, Jalore, Sirohi and the southern parts of Nagaur. Luni River originates in the Aravalli hills near Ajmer and flows south-westward to the great Rann of Kutch. It has number of tributaries contributing to the flow of Luni River when their catchments receive significant rainfall. During the high rainfall spells over the Luni catchment, occasional flash floods occur, which contribute to the groundwater recharge in the basin. Similarly, the basin of Other Nallahs of Jalore District also experiences occasional floods and groundwater recharge in the basins' parts in Rajasthan and in the adjoining State of Gujarat.

The Aravalli hills range, traversing Rajasthan from north-east to south-west nearly in the centre of the State, is the most important feature controlling the State's drainage, its extent and orientation. Mahi and Sabarmati originate in the southern part of the State and are southward flowing are Sukli and West Banas river. The catchments of these rivers receive high rainfall that causes significant runoff, in spite of their small catchments.

2.3 Geology

2.3.1 Introduction

A geological map of Rajasthan prepared by Geological Survey of India is presented in Figure 2.1.

The geological sequence of rock formations of the State is highly varied and complex, revealing the co-existence of the most ancient rocks of pre-cambrian age and the most recent alluvium, as well as wind-blown sands of the Quaternary to Recent age.

A brief geological description of the important geological formations occurring in Rajasthan is discussed in the following paragraphs.

The Archaeans are represented by Bhilwara Supergroup, which consists of high-grade metamorphites and gneisses (Banded Gneissic Complex), together with the associated low-grade metamorphites that represent the oldest metasedimentary sequence.

This super group comprises a complex assemblage of metasemipelite, quartzite, conglomerates, metagraywackes, marble, dolomite, calc-silicate rocks, basic metavolcanics, migmatite, granite, granite-gneiss, granulitic rocks and ultramafics.

Bhilwara Super group has a wide crescent-shaped distribution in eastern Rajasthan, from the south-western border of Bharatpur District to Banswara District. It occupies large areas, mainly in the districts of Sawai Madhopur, Tonk, Ajmer, Bundi, Bhilwara, Udaipur, Chittaurgarh, Pratapgarh and Banswara. In the north, this super group is overlain by Delhi Super group and in the south – by Aravalli Super group.

Granite and gneiss occur over a crescent-shaped area of about 100 km in length and 30 km in width, in central Rajasthan, in the Chittaurgarh and Bhilwara districts. Over a large part of the area the rock is essentially non-porphyric granite, medium grained and varying in colour from reddish pink to greenish yellow.

The geological succession of rock formations in Rajasthan is shown in Table 2.1.

Table 2.1: Geological Succession of Rock Formations in Rajasthan

Geological Time Unit		Lithostratigraphic Period	Lithology
Era	Period	Super group / Group	
Recent			Alluvium and blown sand
Cainozoic	Eocene	Mandai/ Akli/ Kapurdih/ Jogira/	Sandstone,
(Tertiary)		Banda/ Khuiala / Palana	bentonitic clay and fuller's earth
Deccan Traps			Basalt
	Cretaceous	Abur / Fatehgarh	Sandstone, limestone, clay and

Geological Time Unit		Lithostratigraphic Period		Lithology
				lignite
Mesozoic	Jurassic	Parihar/ Bhadesar/ Baisakhi/ Jaisalmer/ Lathi		Limestone, sandstone and shale
	Permo- Carboniferous		Bhadura	Sandstone and boulders
Palaeozoic		Marwar	Nagaur/ Bilara/ Jodhpur	Sandstone, gypsum, siltstone, limestone, dolomite and shale
			Bhander/ Rewa/ Kaimur/ Semri	Sandstone, shale, limestone, conglomerate and basic flows
		Vindhyan		
Upper				
Proterozoic		Acid, Basic and Ultrabasic Intrusives and Extrusives		
		Malani Volcanics / Plutonics		
		Kishangarh Syenite		
			Ajabgarh/ Alwar/ Sirohi/ Punagarh/ Raialo	Quartzite, schist, gneiss, marble, shale, slate, phyllite and basic flows
		Delhi		
Lower		Granite, Basic and Ultrabasic Intrusives		
Proterozoic			Jharol/ Bari/ Udaipur/ Debari	Quartzite, schist, phyllite, conglomerate, greywacke, metavolcanics and marble
		Aravalli		
		Granite and Basic Intrusives		
			Ranthambore/ Rajpura-Dariba	Phyllite, slates, schist, gneiss, granite gneiss and migmatites
Arachaean		Bhilwara	Hindoli	

Source: Geological Survey of India (GSI)

2.3.2 Aravalli Super Group

The Aravalli Super group consists of a great thickness of phyllites and greywacks, with subordinate quartzite, conglomerates and dolomites intruded by granites and basic and ultrabasic rocks. The Aravalli Super group in Rajasthan has been divided into Debari, Udaipur, Bari and Jharol Groups. The rocks of Aravalli Super group are highly metamorphosed at certain places and occur in Udaipur, Dungarpur, Sirohi, and Banswara Districts. The rocks of this Super group also occur to a small extent in the south-western part of Bhilwara District and southwest of Jaipur and Alwar Districts in the north-east. Minerals of great commercial importance are associated with rocks belonging to the Aravalli Supergroup. The central part of the Aravallis is occupied by a great synclinorium composed of Aravalli and Delhi rocks.

2.3.3 Delhi Super Group

The rocks of the Delhi Super group occur over a large part of central and north-eastern Rajasthan, and are exposed in the districts of Bharatpur, Alwar, Jaipur, Ajmer, Udaipur, Jhunjhunu, Sikar, Nagaur, Jodhpur, Pali, Sirohi and Jalore. However, their best occurrence is in the main Aravalli hill ranges near Ajmer and in western Mewar. Delhi Super group has been divided into Raialo, Punagah, Sirohi, Alwar and Ajabgarh groups. This Super group predominantly consists of quartzite, biotite schist, calc-schist, calc-gneiss, phyllite and marble, with subordinates conglomerate and chert.

2.3.4 Vindhyan Super Group

The Delhis were succeeded by the Vindhyans after a time interval marked by a distinct erosional unconformity. The Vindhyans in Rajasthan were deposited in two separate basins on either side of the Aravalli hill range, constituting the main Vindhyan basin in eastern Rajasthan and Trans-Aravalli Vindhyan basin in western Rajasthan.

In the main Vindhyan basin of eastern Rajasthan, especially in south-eastern Mewar, the Vindhyan succession is well developed. The sediments were deposited in a large basin extending from Dhaulpur in the northeast to Nimbhahera and Suket in the southwest. The north-eastern and southwestern outcrops are connected by narrow, disconnected patches extending from Sawai Madhopur to Bundi.

In the south-western part of the Vindhyan basin of eastern Rajasthan the total stratigraphic thickness of Vindhyan Super Group formations is 2,400 m, out of this the lower and upper divisions have 1,000 m and 1,400 m, thickness respectively as per Geological Survey of India (G.S.I.). The Vindhyans have been affected by over-thrusts from the west, resulting in the Great Boundary Fault of about 800 km strike length, with a throw of about 700 m. This has brought the undisturbed Upper Vindhyan against the highly folded pre-Aravallis.

The outcrops of Vindhyan in western Rajasthan are much interrupted by desert sands and alluvium, and consist of about 1,000 m thickness resting on the Malani Rhyolites and Phyllite & Schist of Delhi Super Group. These rocks are grouped into a new Super group called Marwar Super group and are divided into (a) Jodhpur Group, (b) Bilara Group, and (c) Nagaur Group, consisting mainly of sandstones, limestones and sandstones, interbedded shale, gypsum and anhydrite respectively. The age of this Super group is Lower Palaeozoic.

Igneous rocks are represented by a variety of rocks, ranging from acidic to basic and ultra basic rocks.

The Ultra basic rocks are represented by peridotite and pyroxenite, metamorphosed to talc-serpentine-chlorite rocks. These rocks occur in Banswara, Dungarpur, Udaipur, Pali and Ajmer Districts. The ultra basic and basic rocks are intrusive and have been assigned post-Aravalli and post-Delhi ages.

Nepheline-syenite is exposed in the vicinity of Kishangarh town (Ajmer District) and is in the form of sheet-like intrusions into the pre-Aravallis and Banded Gneissic Complex along the margin of the Delhi Supergroup, giving rise to elongated ridges. On the basis of radiometric dating age the nepheline syenites (1,475 m/y) are considered of post-Delhi age.

Erinpura Granite is the principal intrusive into the Delhi Supergroup. It occurs as bosses and sills of all sizes. The outcrops of the Erinpura Granite, isolated at places are found extending from Ajmer and Beawar in the north-east to the main belt of the type area of Erinpura and Mt. Abu in the southwest.

The Malani suite of igneous rocks is represented by the Siwana and Jalore granites, with their acid volcanic representatives known as the Malani Rhyolites, which is composed of felsites and pyroclastic material. The Malani rocks are intrusive into the Delhis and are younger than the Erinpura Granite. The Malani granite shows a marked unconformity with the overlying Trans-Aravalli Vindhyans (Marwar Supergroup) and hence their age may be post-Delhi, and probably younger than Lower Vindhyan.

In western Rajasthan, in Jaisalmer District, a sequence of sediments consisting of two formations – the Rends and the Britannia – occurs over a small area overlying the Malani suite of igneous rocks. On the basis of lithological similarities and their superposition on the Malani igneous rocks this sequence has been considered to be homostadial with the Jodhpur Group and Bhilwara Group and thus considered as representing Cambrian sedimentation in Rajasthan.

The rocks of Mesozoic Era occur in western Rajasthan mainly in Jaisalmer and Barmer Districts. Isolated outcrops are also found at the junction of the borders of Jaisalmer, Jodhpur and Barmer Districts. The Lathi formation of Mesozoic age occupies the maximum area (7,500 km^2) in Barmer District. The lithological units of this era are referred to by different names, as indicated in the stratigraphic succession.

Volcanic activity in the form of fissure eruptions in central and western India marked the close, locally, of the Mesozoic era. In Rajasthan, the northern extensions of Deccan Traps occupy part of south-eastern Mewar and overlie the older formations. The rocks generally show spheroidal weathering and exfoliation, giving rise to rounded boulders.

Outcrops of rocks of Eocene age occur at widely separated areas in Barmer, Bikaner, and Jaisalmer Districts. The relationship is obscure due to the intervening desert sand and alluvium. The litho-units of this era have also been called different names in different locations, as indicated in the stratigraphic succession. The Palana Series, hitherto included in Cretaceous rocks, is now considered to be of Palaeocene age.

Alluvium, blown sand, Kankar and Evaporites are of recent to sub-recent age. Alluvium is fairly thick and widespread in Bharatpur, Sawai Madhopur and parts of Tonk and Jaipur Districts, and also along the valleys of Banas, Banganga, Berach and Chambal rivers. Thick alluvium and blown sand occur in Luni river basin and

several other areas in western Rajasthan covering the Thar Desert. The Thar Desert, along with a vast blanket of unconsolidated deposits, covers the region in the west, north-west and north of Rajasthan. Recent and sub-recent deposits are the most important geological formations in occurrence and possible development of groundwater resources.

Alluvium directly overlies the Pre-Cambrian basement in the central part of the basin where its thickness varies from 242 m in the southern part, around Phulka (29º29':75°08') to 533 m in the northern part around Kheliawala (29°39':73°19').

In Ganganagar and Hanumangarh Districts, the thickness of the alluvium that mostly overlies Palana series, varies from about 130 m in the south to about 400 m in the north.

Concretions and nodules of calcium carbonate, called Kankar, are extensively distributed throughout the vertical column of the alluvium in Ganganagar and Hanumangarh Districts. Kankar encountered towards the bottom of the tubewells drilled at Sri Bijoy Nagar (29°15':73°31'), Dudianwali (29°16':73°52') and Kamharwala (30°19':75°40') occurs as hard pans ranging in colour from greyish brown through yellow to pinkish.

Sand dunes dots occur in Ganganagar District and the intervening depression. Sand dunes consist of silt and very fine sand, brownish yellow to buff in colour coalesced together, and rises in the form of small hillocks, of an average 4 to 5 m height above ground level. The dunes are about 30 m high in the Suratgarh area. Quaternary alluvial deposits from the main aquifers of Ganganagar District.

Rocks belonging to the Proteriozoic Group are not exposed anywhere in the lower Ghaggar river basin. Delhi quartzite has been encountered at a depth of 533 m at Kheliawala (29°39':73°19') and porphyritic hornblende biotite granite, belonging to Malani suite of igneous rocks, has been encountered at a depth of 240 m at Phulka (29°29':75°08').

The Palaeozoic Group of rocks are also not exposed anywhere in Ganganagar and Hanumangarh Districts. Sandstone resembling Jodhpur Sandstone has been encountered in the boreholes drilled at Ottu (29°30':74°53'), on Rajasthan – Haryana border, at a depth of 206 m. The sandstone is pink in colour and fine to coarse-grained.

2.4 Structure

The Precambrians of Rajasthan show a widely varying structural pattern as a result of repeated periods of deformation and igneous intrusions and extrusions. The regional strike of foliation of the rocks of the Bhilwara, Aravalli and Delhi Super groups is predominantly NNE-SSW to NE-SW, varying to N-S and NW-SE in the Aravalli and partly in the pre-Aravallis of south Rajasthan. The foliation dips are steep to moderate, mostly towards west, although local variations in dips towards the east are seen in the pre-Aravallis of Bhilwara-Jahazpur region. The regional structure is defined by the presence of a series of isoclinals, overturned, and at places, as in the Delhis of Alwar region, by normal upright folds. The other major

tectonic element in these rocks is the presence of a series of sub-parallel NE-SW trending faults.

In contrast with the complex deformation history of the above Super groups, the rocks of the main Vindhyan belt, extending from Chittaurgarh to Kota and Dhaulpur in south-east and eastern Rajasthan, are very little disturbed and are composed of low-dipping strata, dipping predominantly towards south and south-south-east. The northern boundary of the Vindhyans is also marked by a major fault, the Great Boundary Fault, which has brought the less disturbed Vindhyan against the highly folded pre-Aravallis rocks of Bhilwara, Tonk, Kota, Sawai Madhopur and Bharatpur Districts. The Vindhyan rocks along this fault zone are highly folded and locally metamorphosed.

The rocks of the Marwar Super group, Mesozoic and Tertiary eras of western Rajasthan are completely undisturbed and constitute very low-dipping strata, marked at places by gravity faults.

The structure of the basement and nature of the overlying rocks is known from the geophysical studies and the drilling carried out by ONGC (Oil and Natural Gas Commission) and the Central Groundwater Board. The Delhi system of rocks, parts of the old peninsular shield, protrudes in the form of a subsurface ridge or a gentle upwarp, which runs roughly NW-SE along the Jind-Mansa-Bhatinda alignment, subdividing the Ghaggar river basin into two parts - upper and lower. Sedimentation in these two sub-basins continued separately till the Tertiary period. During quaternary times, when the alluvium was deposited, it was one basin. The ridge separating the two parts of Ghaggar river basin is quite shallow in the southern part, i.e. Ganganagar and Hanumangarh districts. It deepens on the north-western side. This is well revealed by the presence of Precambrian rocks immediately below the alluvium, at 242 m at Pulkha and 533 m at Kheliwala.

There is no evidence from the exploratory drilling carried out in the north-eastern part of Ghaggar river basin (Haryana and Punjab) about the depth of the basement and its configuration. But on the basis of the geophysical surveys carried out by ONGC, it has been established that the basement is sloping in the form of a monocline, becoming deeper towards the foothills of Shiwalik, where it attains the maximum thickness of about 2.4 kms. The base of the alluvium in Ganganagar and Hanumangarh districts, which rests on rocks belonging to Jodhpur, Nagaur and Palana series, is sloping gently towards north-west.

The Delhi system of rocks which form part of the old peninsular shield, protrudes in the form of a subsurface ridge or a gentle upwarp, which runs roughly north-west to south-east along the Jind-Mansa-Bhatinda alignment, thereby separating the lower Ghaggar river basin, of which a major part lies in Rajasthan, from the central and upper part of Ghaggar river basin, a major part of which lies in Haryana and Punjab States. Alluvium directly overlies the Pre-cambrian basement of Punjab – Haryana, where its thickness varies from 242 m in the southern part around Phulka (29°29':75°08') to 533 m at Kheliwala. According to the geological surveys carried out by ONGC, the basement slopes towards north to north-east as a monocline and attains a maximum thickness of 2.4 kms near the foothills of Shiwaliks. In the

districts of Ganganagar and Hanumangarh, the basement belonging to Jodhpur, Nagaur and Palana series gently slopes towards north-west, towards Punjab.

2.5 Hydrogeological Units

The classification of hydrogeologic units is based on hydraulic parameters and the assessed potential of each rock unit. Groundwater analysis for any purpose should differentiate between the various water-bearing formations.

A total of 19 hydrogeological units have been identified on the basis of CGWB and RGWD data base (see Table 2.2). The significant and mapable hydrogeological units are considered to serve the purposes of water resources planning. The hydrogeological units were delineated using water-bearing formation data of CGWB and RGWD. The same have been delineated on micro-watershed, using GIS, and also panchayat samiti-wise (block-wise) and village-wise. Hydrogeological map of Rajasthan state is shown in Figure 2.2.

The various units present a wide array of exploitation potential, quantity-wise as well as quality-wise. While some of the units present similar hydraulic characteristics and groundwater potential, others may exhibit totally different features and qualities. For example, the Sandstone, Limestone and Alluvium units are usually considered to be the better aquifers, whereas the various fractured rock aquifer units usually present poor hydraulic conditions. As a result, the hard rock aquifers are more extensively developed while successful pumping wells in the fractured rock are rarer.

Table 2.2: Major 19 Hydrogeological Formations and their Areas in Rajasthan

S. No.	Hydrogeological Units / Hills	Area, Km^2
1	Younger Alluvium	48,070.05
2	Older Alluvium	94,968.09
3	Tertiary Sandstone	24,502.65
4	Deccan Traps (Basalt)	9,580.51
5	Jurassic Sandstone (Lathi, Parihar, Baisakhi, Bhadesar)	15,213.07
6	Vindhyan Sandstone (Nagaur, Jodhpur)	25,675.64
7	Bilara Limestone	9,522.51
8	Bhander Sandstone	13,954.29
9	Limestone (Alwar, Bhander, Upper Cretaceous)	4,853.08
10	Shale	3,906.68
11	Quartzite	5,325.02
12	Slate	367.65
13	Phyllite & Schist	35,728.18
14	Gneisses	1,967.40
15	Jalore Granite	5,612.72
16	Erinpura Granite	5,229.75
17	Rhyolite	5,046.40
18	Ultra Basics	107.72
19	Gneisses(B.G.C.)	21,724.31
20	Hills	10,908.08
	Total	342,263.80

Source: CGWB and RGWD

Hydrogeological characteristics of above 19 aquifer units is given in the Table 2.3.

Broadly, the alluvial aquifers are porous and extensive and sedimentary, crystalline and metamorthic aquifers have dual permeability character determined by weathered zone on top followed by thickness of jointed and fractured zone. The characteristics of 19 hydrogeological units have been tabulated as per data available as on year 2010.

Table 2.3: General Aquifer Characteristics of 19 Hydrogeological Formations

S. No.	Aquifer	Nature of Aquifer	SWL* m, bgl	Yield potential, lps	Transmissivity m^2/d	Specific Yield
A.	**Alluvial Aquifers**					
1	Younger Alluvium	Porous, permeable and have limited occurrence	2.75-26.33	6.10-20.00	-	0.15
2	Older Alluvium	Porous, permeable and have wide occurrence	1.00 to 130	5.00-50.00	13.32-7,944.00	0.1
B.	**Sedimentary Aquifers**					
1	Tertiary Sandstone	Porous, permeable and jointed	30.05-7.06	1.80-9.16	74.00-1,516.00	0.06
2	Bilara Limestone	Cavernous, jointed and fractured	9.10-56.08	6.25-75.70	-	0.07
3	Limestone (Alwar, Bhander, Upper-Cretaceous,)	Occasionally, cavernous, jointed and fractured. Often intercalated with Shale	27	<5.00-15.00	-	0.03
4	Jurassic Sandstone (Lathi, Parihar, Baisakhi, Bhadesar)	Porous, permeable. Intercalated with Shale	6.75-22.56	4.60-64.70	1,161.00-1,883.00	0.06
5	Vindhyan Sandstone (Nagaur, Jodhpur,)	Porous, permeable. Intercalated with Shale	2.06-58.40	0.50-8.00	30.00-1649.00	0.04
6	Bhander Sandstone	Occasionally Porous, Jointed fractured and quartzitic in nature. Often intercalated with Shale	3.11-12.46	1.00-6.00	39.00-1,138.00	0.02
7	Shale	Jointed and Fractured	6.85-41.44	0.60-60.00	55.00-269.9	0.015
C.	**Hard-Rock Aquifers**					
1	Deccan Traps (Basalt)	Occasionally vesicular Jointed and Fractured	1.35-10.54	1.10-8.30	3.00-249.00	0.01
2	Rhyolite	Jointed and Fractured	17.22-9.87	0.10-0.15	-	0.01
3	Jalore Granite	Jointed and Fractured	10.20-9.20	3.00-5.00	-	0.02
4	Erinpura Granite	Jointed and Fractured	38	1.00-16.00	-	0.02
5	Gneisses	Jointed and Fractured	3.41-43.80	5.00-20.00	12.00-305.00	0.015
6	Quartzite	Jointed and Fractured	7.60-80.00	<5.00-6.00	10.00-404.00	0.02
7	Slate	Jointed and Fractured	16.8	0.50-5.50	-	0.02
8	Ultra-Basics	Jointed and Fractured	-	-	-	0.02
9	Phyllite and Schist	Jointed and Fractured	1.10-63.00	0.15-20.00	6.52-115.00	0.02
10	Gneisses (B.G.C)	Jointed and Fractured	0.43-16.17	0.33-10.00	-	0.015

Source: CGWB and RGWD

* Static Water Level is based on the data from 1963 to 2010

The yield of wells in alluvial aquifers range for less than 5 to 50 lps. The yield of wells in hard-rock aquifers in general range from 5 to 20 lps except for Bilara limestone and Jurassic sandstone aquifers (Lathi, Parihar etc.) which have maximum yield of 75.70 and 64.70 lps respectively and the maximum yield of wells in Shale aquifer is 60 lps as shown in Table 2.3.

Aquifer-wise fluctuation in levels of ground water for 19 aquifer units in the state is shown in Table 2.4.

Table 2.4: Aquifer-wise Ground Water Level Fluctuation in Rajasthan

ACZ	Fluctuation of Ground water level (m)		
	Min	Max	Average
Younger Alluvium	-7.01	10.60	0.81
Older Alluvium	-7.23	10.76	1.26
Deccan Traps	-5.05	10.30	3.06
Tertiary Sandstone	-3.90	8.90	0.33
Jurassic Sandstone	-5.50	7.50	0.36
Vindhyan Sandstone	-6.10	10.79	0.71
Bhander Sandstone	-6.93	10.60	3.02
Bilara Limestone	-1.95	10.80	1.33
Limestone	-3.55	10.50	2.65
Shale	-6.85	10.10	3.89
Rhyolite	-6.28	9.83	2.50
Jalore Granite	-5.43	10.55	4.54
Erinpura Granite	-1.55	10.80	5.33
Gneisses	-0.93	10.68	6.10
Quartzite	-4.05	10.34	3.05
Slate	0.25	6.50	3.47
Ultra Basics	1.50	4.83	3.08
Phyllite & Schist	-6.10	10.76	4.39
Gneisses(B.G.C.)	-3.50	10.75	4.65
Grand Total	**-7.23**	**10.80**	**2.67**

3. Climate

3.1 Introduction

The following climate data has been collected:

a) Rainfall data at daily intervals were provided by Water Resources Department (WRD), Jaipur for the period 1957-2010 (54 years) for raingauge stations maintained by Indian Meteorological Department (IMD), Water resources Department (WRD) and Revenue Department. The availability of rainfall data within this period of observation varies between the stations. There are 542 listed rainfall stations, of which 327 were filtered out for filling of data gaps. Details of these stations are given in Appendix 2.

b) Data on monthly weather parameters were made available from IMD weather stations that include maximum and minimum temperature, wind speed, solar radiation, evaporation and relative humidity for the time period of 1990-2009 (20 years).

These climatic data are also required for the computation of actual evapotranspiration and consequently the crop water requirements.

Weather parameter data were collected for the past 21 years (1990 - 2010), but data for 2010 provided by IMD Pune was found insufficient in terms of number of records observed and provided (only 3 months) therefore it was discarded outright for any further analysis. There are a total of 30 IMD stations for which data are available, but on scrutiny it was found that the availability of data for various weather parameters is different in various stations. Details of these weather stations alongwith data availability is given in Appendix 3.

3.2 Temperature

The observed temperatures in Rajasthan for the period 1990-2009 show a large temporal variability, as shown in Table 3.1.

Table 3.1: Maximum and Minimum Temperature Statistics in Rajasthan

Season	Statistics	Maximum Temperature, °C	Minimum Temperature, °C	Highest Maximum Temperature, °C	Lowest Minimum Temperature, °C
Annual	Mean	33.2	19.1	45.2	3.3
	Spatial Range	25.7 to 35.0	11.8 to 21.8	43.2 to 46.8	1.6 to 6.1
Cold Weather (Dec. – Jan. – Feb.)	Mean	25.7	9.6	34.6	1.2
	Spatial Range	19.7 to 30.3	3.1 to 14.7	29.0 to 39.2	-7.4 to 6.7
Pre Monsoon (Mar. – Apr. – May)	Mean	37.4	21.5	44.7	12.1
	Spatial Range	26.5 to 43.4	10.3 to 30.0	34.6 to 49.9	0.6 to 21.0
Monsoon (Jun. – Jul. – Aug. – Sep.)	Mean	35.5	25.1	43.1	17.8
	Spatial Range	23.5 to 42.0	15.6 to 29.5	31.6 to 50.0	6.4 to 22.2
Post Monsoon	Mean	32.6	16.4	39.2	8.2

Season	Statistics	Maximum Temperature, °C	Minimum Temperature, °C	Highest Maximum Temperature, °C	Lowest Minimum Temperature, °C
(Oct. – Nov.)	Spatial Range	24.4 to 37.1	7.0 to 22.5	38.0 to 46.8	4.4 to 16.6

Source: IMD monthly temperature data (1990 - 2009)

It is evident from Table 3.1 that the maximum temperature is highest in (37.4°C) the pre-monsoon season, while it is lowest (25.7°C) in cold weather season. Mean annual maximum temperature in Rajasthan is 33.2°C with a range of 25.7°C - 35.0°C. Minimum temperature attains its Mean highest value (25.1°C) during monsoon season, while it attains its Mean lowest value (9.6°C) in cold weather season. Mean annual Minimum temperature within Rajasthan is 19.1°C with a range of 11.8°C - 21.8°C.

Highest Maximum temperature attains its maximum value during Pre-Monsoon season (44.7°C) while it is lowest during Cold Weather season (34.6°C). Lowest Minimum temperature attains it lowest value during Cold weather (1.2°C) while it is highest during Monsoon season (17.8°C).

Table 3.2 shows mean daily maximum and minimum temperatures for the period 1990 to 2009. Both maximum and minimum temperature shows an increasing trend within the study period of 20 years, as reflected by their positive trend and statistically significant confidence level. Table 3.3 shows the monthly mean daily maximum and minimum temperatures over 20 years (1990 - 2009).

Table 3.2: Mean Daily Maximum and Minimum Temperatures per Year, °C

Year	Mean Maximum	Mean Minimum
1990	32.7	18.5
1991	33.2	19.3
1992	32.8	18.8
1993	33.7	19.0
1994	32.9	18.4
1995	33.4	19.2
1996	33.1	18.3
1997	31.3	18.5
1998	33.1	19.3
1999	33.4	18.7
2000	33.7	18.7
2001	32.9	18.9
2002	34.3	20.0
2003	32.7	18.5
2004	34.3	20.2
2005	33.1	18.8
2006	33.6	19.7
2007	33.3	19.5

Year	Mean Maximum	Mean Minimum
2008	33.2	19.4
2009	34.2	20.2
Mean	33.2	19.1
Positive (P) or Negative (N) trend	P	P
Confidence Level, %	91.0	98.0
Temperature increase, °C (1990-2009)	0.8	1.1
Incremental change per year, °C	0.04	0.06

Source: IMD Monthly dataset (1990-2009)

Table 3.3: Mean Daily Maximum and Minimum Temperatures by Months, °C

Month	Mean Maximum	Mean Minimum
January	24.0	8.2
February	27.3	11.2
March	32.9	16.5
April	38.3	21.9
May	41.1	26.2
June	39.5	27.0
July	34.8	25.6
August	33.2	24.5
September	34.4	23.4
October	34.6	19.1
November	30.5	13.6
December	25.9	9.3
Monthly Mean	33.0	18.9

Source: IMD Monthly dataset (1990-2009)

Figure 3.1 show mean daily maximum and minimum temperature variations over 20 years (1990-2009) while Figure 3.2 show mean daily maximum and minimum temperature variation during the months based on 20 years data (1990-2009).

Figure 3.1: Mean Daily Maximum and Minimum Temperatures per Year, °C

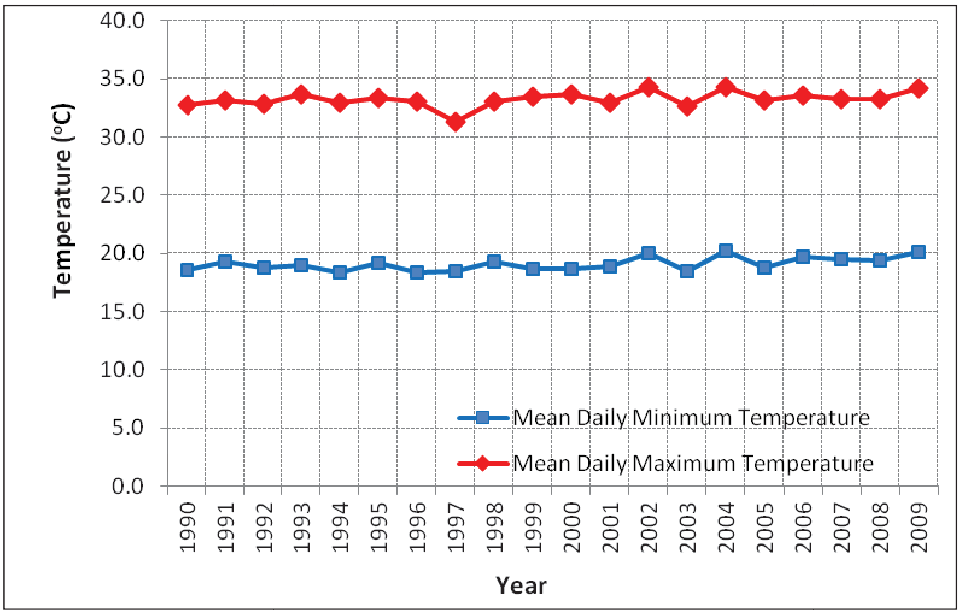


Figure 3.2: Mean Daily Maximum and Minimum Temperatures per Month

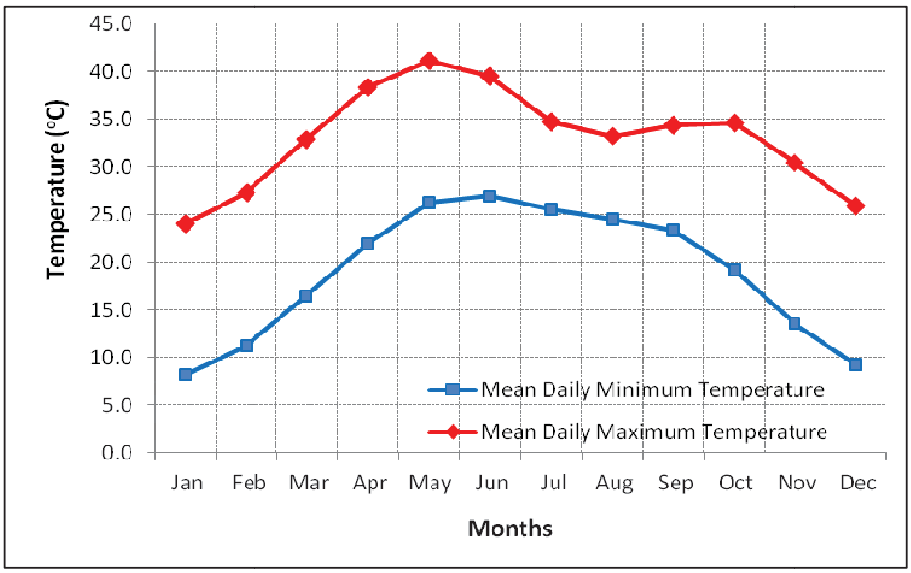


Table 3.4 shows the mean daily highest maximum and lowest minimum temperatures during the 20 years period from 1990 to 2009. It shows that the highest maximum temperature has decreasing trend and lowest minimum temperature has rising trend but since the confidence level is less than 90% the trend is considered insignificant. Table 3.5 shows mean daily highest maximum and lowest minimum by months based on 20 years data (1990-2009).

Table 3.4: Mean Highest Daily Maximum and Lowest Minimum Temperatures by year, °C

Year	Highest Max.	Lowest Min.
1990	44.2	1.7
1991	45.8	1.6
1992	45.7	3.2
1993	45.4	4.1
1994	46.7	2.7
1995	46.4	3.9
1996	44.9	3.5
1997	43.2	3.4
1998	46.8	3.2
1999	45.1	3.7
2000	44.6	2.0
2001	45.4	3.1
2002	45.8	4.0
2003	45.4	3.2
2004	45.2	4.4
2005	44.9	3.1
2006	45.4	3.3
2007	44.6	3.9
2008	43.6	2.2
2009	45.6	6.1
Mean	45.2	3.3
Positive (P) or Negative (N) trend	N	P
Confidence Level, %	70.0#	81.0#

Source: IMD Monthly dataset (1990 – 2009)
# indicates insignificant trend, as the confidence level is less than 90%.

Table 3.5: Mean Daily Highest Maximum and Lowest Minimum Temperatures by Months, °C

Month	Highest Max.	Lowest Min.
January	33.2	0.3
February	36.7	2.1
March	41.6	6.7
April	45.1	12.1
May	47.5	17.6
June	47.2	17.6
July	43.8	18.2
August	40.4	19.1
September	41.0	16.3
October	40.8	10.9
November	37.5	5.4
December	34.0	1.2
Monthly Mean	40.7	10.6

Source: IMD Monthly dataset (1990 – 2009)

Figure 3.3 and Figure 3.4 shows mean daily highest maximum and lowest minimum temperature variations over 20 years (1990-2009) and by months based on 20 years data (1990-2009), respectively.

Figure 3.3: Mean Daily Highest Maximum and Lowest Minimum Temperatures per Year, °C

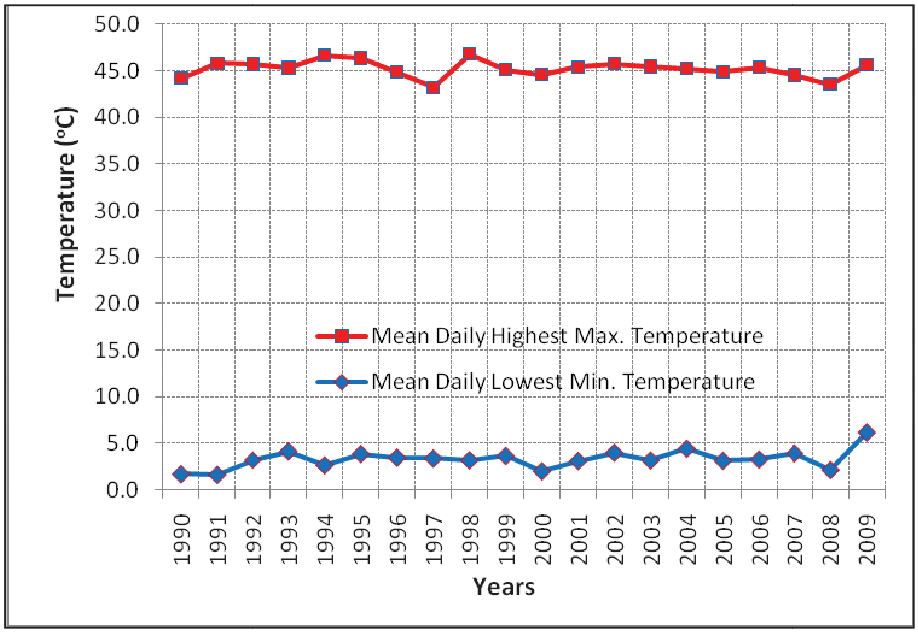


Figure 3.4: Mean Daily Highest Maximum and Lowest Minimum Temperature per Month

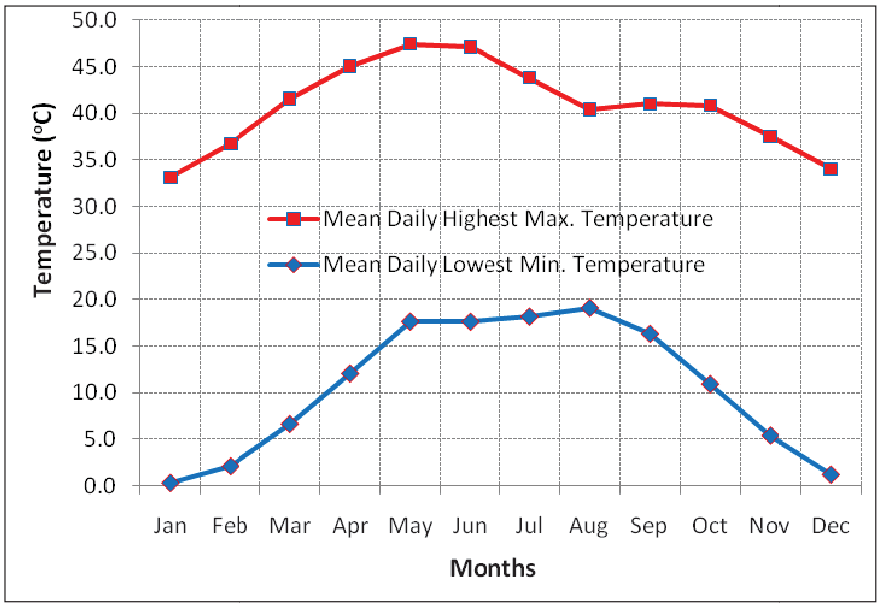


Figure 3.5 and Figure 3.6 show the variation of Mean Annual Daily Maximum and Minimum temperature in Rajasthan, respectively. Figure 3.7 and Figure 3.8 show the Mean Annual Daily Highest Maximum and Mean Annual Daily Lowest Minimum temperature in Rajasthan, respectively.

3.3 Rainfall

Rainfall in the state of Rajasthan varies considerably from year to year, both in space and in time. Table 3.6 gives the summary of observed rainfall in Rajasthan over various seasons.

Table 3.6: Rainfall Statistics in Rajasthan

Season	Statistics	Value	Contribution to Annual Rainfall, %
Annual	Mean, mm	495.60	
	Inter-annual variation, CV*	0.40	
	Spatial Range, mm	244.00 – 782.80	
Cold Weather (December –January-February)	Mean, mm	10.90	2.20
	Inter-annual variation, CV*	0.50	
	Spatial Range, mm	3.60 – 17.90	
Pre-Monsoon (March-April-May)	Mean, mm	16.90	3.40
	Inter-annual variation, CV*	0.45	
	Spatial Range, mm	6.80 – 29.20	
Monsoon (June-July-August-September – JJAS)	Mean, mm	454.00	91.60
	Inter-annual variation, CV*	0.44	
	Spatial Range, mm	200.60 – 744.80	
Post Monsoon (October-November)	Mean, mm	13.80	2.80
	Inter-annual variation, CV*	0.54	
	Spatial Range, mm	4.30 – 26.20	

Source: WRD rainfall data (1957 – 2010) which includes stations from IMD, WRD and Revenue department
* CV – Coefficient of Variation[1]

From the above table it can be observed that the monsoon season (June, July, August and September – JJAS) mean rainfall (454 mm) is maximum amongst all 4 seasons and contributes 91.6% of the annual rainfall (495.6 mm). Figure 3.9 and Figure 3.10 shows observed rainfall in the monsoon season and the variation of mean annual rainfall across Rajasthan, respectively. Figure 3.11 shows total annual number of rainy days in Rajasthan. The district-wise values of monsoon rainfall, mean annual rainfall and number of rainy days from Figure 3.9, 3.10 and 3.11, respectively are shown in Table 3.7.

[1] Coefficient of Variation (CV): A statistical measure of the dispersion of data points in a data series around the mean. The coefficient of variation represents the ratio of the standard deviation to the mean, and is a measure of relative dispersion used to compare variation in series which differs in magnitude of their means. The higher the CV, the greater is the dispersion in the variable.

Table 3.7: District-wise Monsoon Rainfall, Mean Annual Rainfall and Number of Rainy Days

District	Monsoon Rainfall, mm	Mean Annual Rainfall, mm	Number of Rainy Days
Ajmer	408.06	438.02	22
Alwar	568.22	638.40	32
Banswara	819.53	859.66	34
Baran	723.51	761.19	34
Barmer	245.52	268.49	14
Bharatpur	550.12	602.40	30
Bhilwara	534.68	567.81	27
Bikaner	220.50	265.89	16
Bundi	598.73	636.73	30
Chittaurgarh	663.90	703.54	30
Churu	316.82	363.14	21
Dausa	573.08	621.64	32
Dhaulpur	575.12	616.81	30
Dungarpur	656.33	692.40	30
Ganganagar	181.97	223.88	13
Hanumangarh	217.49	258.51	15
Jaipur	503.63	556.59	29
Jaisalmer	184.28	204.77	12
Jalore	427.23	454.87	20
Jhalawar	824.39	881.18	37
Jhunjhunun	400.51	462.91	26
Jodhpur	263.38	286.89	16
Karauli	580.53	624.68	31
Kota	711.59	760.50	33
Nagaur	346.61	386.72	21
Pali	379.51	396.70	20
Pratapgarh	806.67	852.50	35
Rajsamand	484.47	521.00	27
Sawai Madhopur	611.88	650.98	31
Sikar	412.13	468.86	25
Sirohi	579.98	602.50	26
Tonk	502.49	529.34	26
Udaipur	584.52	612.79	30

Source: WRD rainfall data (1957–2010) which includes stations from IMD, WRD and Revenue Department

The highest mean monthly rainfall occurs in the middle months of July and August, with 198.4 and 164.0 mm respectively in each month, contributing about 67.1% of the annual rainfall, while June and September rainfalls contribute 10.5% and 14.0%, respectively. It is observed that contribution of the other three seasons to annual rainfall is marginal. Winter, pre-monsoon and the post-monsoon seasons contribute 2.2%, 3.4% and 2.8%, respectively.

Table 3.8 and 3.9 present district-wise data on normal rainfall and number of rainy days based on IMD District Normal, 1950-1980.

Table 3.8: District-Wise IMD Monthly Normal Rainfall, mm

Districts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Ajmer	8.9	5.0	7.7	1.8	9.8	58.5	210.6	187.7	94.5	7.5	5.6	4.2	601.8
Alwar	12.7	11.8	9.0	4.7	15.3	58.1	180.4	199.4	137.1	19.3	2.7	6.8	657.3
Banswara	3.5	2.6	2.2	0.6	5.8	95.5	33.4	301.7	173.0	24.1	5.4	2.5	950.3
Baran	8.2	3.6	3.3	2.7	7.5	81.3	316.1	298.0	126.7	15.0	6.4	5.0	873.8
Barmer	2.1	3.1	3.7	1.2	7.4	19.7	85.8	103.3	34.8	2.6	0.9	1.4	266.0
Bharatpur	10.7	11.9	8.9	4.7	9.2	45.3	200.0	225.1	122.1	17.5	2.7	5.8	663.9
Bhilwara	5.6	2.4	4.9	1.0	2.4	52.0	228.2	248.5	113.4	19.3	1.6	3.9	683.2
Bikaner	3.4	9.6	8.0	1.2	10.5	17.4	63.9	58.8	60.3	2.6	2.6	4.7	243.0
Bundi	7.0	3.9	4.1	2.1	8.3	65.4	286.7	260.9	113.0	15.5	3.0	3.5	773.4
Chittaurgarh	6.8	1.6	5.9	1.3	8.7	61.3	280.1	300.0	151.3	17.7	3.5	3.3	841.5
Churu	9.8	6.6	5.6	4.3	10.6	35.4	108.1	109.1	50.5	8.4	1.6	4.7	354.7
Dausa	9.1	7.6	5.7	2.2	9.9	42.1	189.3	180.9	89.9	14.3	3.4	6.6	561.0
Dhaulpur	14.6	8.2	7.3	3.9	8.0	55.0	221.1	264.5	131.0	22.2	3.5	5.2	744.5
Dungarpur	3.0	1.7	2.3	1.5	8.5	88.7	271.3	197.3	130.1	18.1	5.2	1.2	728.9
Ganganagar	7.5	6.9	10.6	3.4	8.1	25.0	61.9	67.5	28.7	1.3	0.6	4.9	226.4
Hanumangarh	8.7	9.9	6.7	4.4	6.5	27.3	83.6	77.3	40.0	4.3	0.5	4.3	273.5
Jaipur	3.5	12.0	2.3	2.1	13.6	28.8	160.9	252.5	72.6	7.5	3.8	4.2	563.8
Jaisalmer	2.6	5.1	3.6	2.3	7.1	14.0	57.7	66.9	21.9	1.2	1.4	1.7	185.5
Jalore	2.5	3.9	3.7	1.2	7.3	30.1	115.9	135.3	58.5	9.5	1.1	1.0	370.0
Jhalawar	12.2	0.2	7.1	1.3	1.0	49.4	260.2	319.3	172.3	10.5	7.2	3.6	844.3
Jhunjhunu (P)	8.4	9.1	6.8	5.4	13.4	40.6	127.5	114.5	61.5	10.4	2.0	5.4	405.0
Jodhpur	4.6	2.8	3.6	1.0	5.2	24.5	101.7	128.9	36.2	3.0	1.5	0.7	313.7
Karauli	10.6	6.9	6.0	3.0	9.7	49.0	232.3	260.5	105.2	18.5	3.6	4.1	709.4
Kota	5.5	0.1	5.2	1.0	9.2	53.0	257.7	237.7	150.5	6.5	4.4	1.6	732.4
Nagaur	5.1	7.4	5.4	2.8	12.0	29.4	92.8	107.7	39.4	4.9	1.0	3.9	311.8
Pali	3.2	3.6	2.8	1.4	5.6	40.7	128.3	167.6	62.4	5.9	1.4	1.5	424.4
Pratapgarh	3.7	2.8	4.1	5.3	8.6	100.9	272.9	261.4	152.8	23.7	6.8	1.9	844.9
Rajsamand	5.6	1.3	6.8	0.6	6.1	55.5	178.3	178.4	116.6	15.8	1.6	1.2	567.8
Sawai Madhopur	8.2	5.1	6.1	1.4	6.2	68.8	316.9	318.4	124.7	10.8	2.1	4.7	873.4
Sikar	8.6	7.6	7.3	3.2	14.7	38.9	142.9	144.1	54.8	8.3	3.9	6.0	440.3
Sirohi	3.1	4.4	4.2	2.2	12.6	46.4	202.6	212.0	90.1	10.1	2.2	1.2	591.1
Tonk	7.7	5.2	4.6	2.0	9.8	59.4	237.9	225.6	94.4	13.6	4.2	3.9	668.3
Udaipur	3.1	1.3	17.3	3.6	6.2	78.1	190.1	203.9	124.2	12.7	3.7	0.8	645.0
State Mean	5.9	4.3	5.6	2.0	7.7	47.6	190.2	193.4	100.7	11.0	3.1	3.6	575.1

Table 3.9: District-Wise IMD Normal Number of Rainy Days, Days

Districts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Ajmer	1	1	0	0	1	3	8	8	4	1	0	0	26
Alwar	1	1	1	1	1	3	9	9	5	1	0	1	32
Banswara	0	0	0	0	0	4	14	12	6	1	0	0	39
Baran	1	1	0	0	1	5	14	12	6	1	1	1	42
Barmer	0	0	0	0	1	1	4	4	2	0	0	0	13
Bharatpur	1	1	1	1	1	3	10	11	6	1	0	1	35
Bhilwara	1	0	0	0	1	3	11	10	4	0	0	0	32
Bikaner	0	1	1	0	1	2	5	5	2	0	0	0	17
Bundi	1	1	0	0	1	4	12	11	5	1	0	0	35
Chittaurgarh	1	0	0	0	1	4	11	11	5	1	0	0	34
Churu	1	1	1	0	1	2	5	5	3	0	0	0	19
Dausa	1	1	1	0	1	3	10	10	5	1	0	1	33
Dhaulpur	1	1	1	1	1	3	12	12	6	1	0	1	39
Dungarpur	0	0	0	0	1	4	12	11	5	1	0	0	35
Ganganagar	1	1	1	1	1	2	4	4	2	0	0	0	16
Jaipur	1	1	1	0	1	3	10	9	4	1	0	0	32
Jaisalmer	0	0	0	0	0	1	3	3	1	0	0	0	8

Districts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Jalore	0	0	0	0	0	2	6	6	3	0	0	0	19
Jhalawar	1	1	1	0	1	6	14	12	7	1	1	1	44
Jhunjhunu	1	1	1	1	2	3	7	7	3	1	0	1	27
Jodhpur	0	1	0	0	1	2	5	6	2	0	0	0	18
Kota	1	1	0	0	1	5	13	12	6	1	1	1	41
Nagaur	1	1	1	0	1	3	6	6	3	0	0	0	22
Pali	0	1	0	0	1	3	7	7	3	1	0	0	23
Rajsamand	0	0	0	0	0	2	8	6	4	0	0	0	21
Sawai Madhopur	1	1	1	0	1	4	11	11	5	1	0	1	36
Sikar	1	1	1	1	1	3	9	9	4	0	0	1	30
Sirohi	1	1	0	0	1	3	10	9	4	1	0	0	29
Tonk	1	1	1	0	1	3	10	10	5	1	0	0	33
Udaipur	0	0	0	0	1	3	10	8	5	1	0	0	28
Karauli	1	1	1	0	1	4	11	11	5	1	0	1	35
Pratapgarh	0	0	0	0	1	4	12	10	5	1	0	0	34
Hanumangarh	1	1	1	1	1	2	4	4	2	0	0	0	17
Rajasthan East	1	1	1	0	1	4	11	10	5	1	0	0	34
Rajasthan West	1	1	0	0	1	2	5	5	2	0	0	0	17
Rajasthan State	1	1	1	0	1	3	9	9	4	1	0	0	29

Note: A rainy day is a day on which 2.5 millimetres or more of rain are recorded.

The observed trend of rainfall is as follows:

In June, there is an increasing trend in rainfall. However, only at few locations the trend is significant, with a confidence level > 90%, while trends in the rest areas are statistically insignificant.

In July, again at few locations the increasing trends in rainfall are statistically significant, with confidence levels >90%. The rest of the areas show statistically insignificant trends.

In August, at few locations the decreasing trends in rainfall are statistically significant while the trends in the rest of the areas are statistically insignificant.

In September, none of the areas show any significant trend.

Rainfall in Rajasthan can be termed erratic on the basis of the analysis done on the raingauge stations maintained by different departments, with high temporal as well as spatial variability, as can be seen from Figure 3.12. Green dots in this figure signify stations with positive or increasing trends, while red dots signify decreasing trend at a confidence level greater than 90%. The rest of the stations show statistically insignificant or no trend. Among the significant stations, 24 are showing an increasing trend while 28 show a decreasing trend. The stations lying in the eastern region of Rajasthan have strong statistically significant negative trends while statistically significant positive trends are observed in the south of Rajasthan. There are many factors that can affect the rainfall over an area. Some of the major factors are atmospheric pressure variation, orography, temperature variation, relative humidity, vegetative cover, and there may be some instrument-related and human errors in the rainfall observations. Some of the instrument-related and human errors include a faulty instrument, instrument type, instrument height, type of observation (manual or automatic) and method of measurement.

Figure 3.12 presents a summary of the observed trends in monsoon rainfall over the State and the statistical significance of these trends.

The number of rainy days (a day is considered a rainy day when it receives rainfall greater than 2.5 mm) show increasing trend (as per 1957 to 2010 data) but the trend is not significant. Also the rainfall intensity analysis show insignificant trend.

3.4 Evaporation

Evaporation in Rajasthan is highly variable, both in spatial and temporal terms. Annual evaporation ranges from 140 cm to over 300 cm over the State. Values exceeding 300 cm occur over western Rajasthan (observed at the IMD weather station in Jaisalmer), which mainly comprises a desert area. It is generally the highest during May (when it ranges from about 26 cm to 43 cm) over most parts of the State and continues to be high in June too. The minimum usually occurs in December and January, when evaporation ranges from about 4 cm to 12 cm per month.

Table 3.10 and Table 3.11 shows the total annual and mean monthly evaporation rates, respectively, for Rajasthan as a whole, obtained using data of the 20-year period of 1990 to 2009. From Table 3.10 it is evident that the total annual evaporation shows no significant trend within 20 year study period. Figure 3.13 and Figure 3.14 depicts the mean monthly evaporation and total annual evaporation during years 1990 to 2009, respectively in Rajasthan. District-wise mean monthly evaporation rates are shown in Table 3.12.

Table 3.10: Mean Annual Evaporation for Rajasthan State, cm

Year	Evaporation, cm
1990	222.7
1991	226.2
1992	210.4
1993	222.2
1994	205.3
1995	207.4
1996	213.6
1997	201.0
1998	215.6
1999	225.4
2000	229.0
2001	215.6
2002	255.0
2003	208.2
2004	221.5
2005	219.3
2006	203.4
2007	195.6
2008	199.1

Year	Evaporation, cm
2009	208.0
Mean	215.1
Positive (P) or Negative (N) Trend	P
Confidence Level, %	70.6#

Source: IMD Monthly Dataset from 1990 to 2009
# indicates insignificant trend, as the confidence level is less than 90%.

Table 3.11: Mean Monthly Evaporation for Rajasthan State, cm

Month	Evaporation, cm
January	8.5
February	10.8
March	18.7
April	26.6
May	34.6
June	30.4
July	21.4
August	16.8
September	16.6
October	15.7
November	11.0
December	8.4
Annual	219.5
Mean Monthly	18.3

Source: IMD Monthly Dataset from 1990 to 2009.

Figure 3.13 Annual Evaporation During 1990-2009, cm

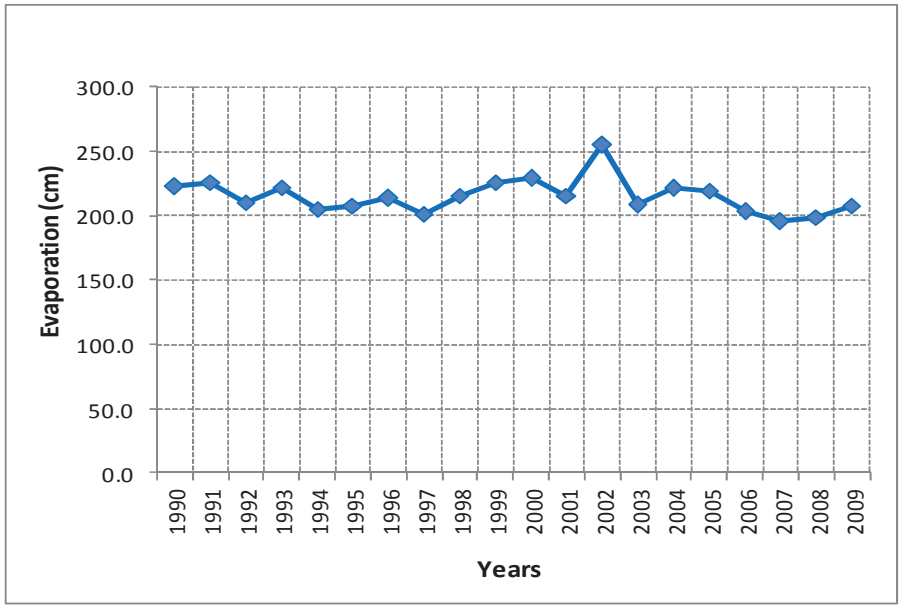


Figure 3.14: Mean Monthly Evaporation, cm

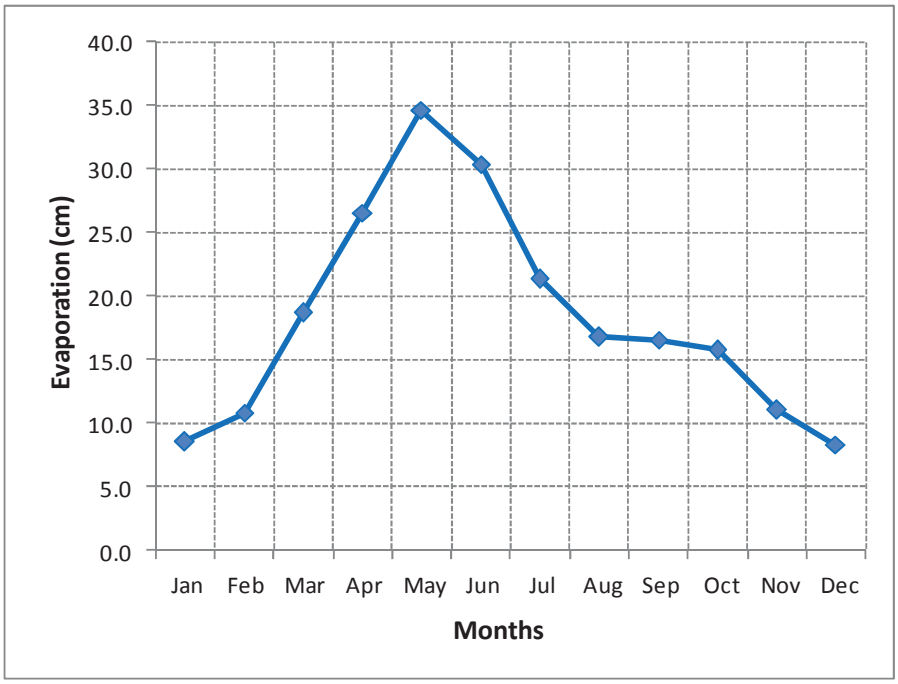


Table 3.12: District-Wise Mean Monthly Evaporation, cm

District	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Monthly Mean	Annual
Ajmer	8.4	11.0	19.1	26.9	35.5	31.0	19.6	14.7	15.3	10.9	8.4	15.5	18.0	216.3
Alwar	7.9	10.8	18.7	26.7	35.2	31.5	20.3	16.0	15.7	10.7	8.0	16.7	18.2	218.4
Banswara	10.0	11.1	17.9	25.7	37.3	33.8	21.3	13.2	14.0	12.1	10.7	13.6	18.4	220.7
Baran	8.6	10.9	19.3	27.5	36.6	31.1	18.5	12.6	14.5	10.9	8.5	13.9	17.7	212.9
Barmer	10.3	12.0	18.7	24.9	31.3	28.2	23.1	18.2	18.6	13.7	10.5	18.6	19.0	228.1
Bharatpur	8.1	10.9	18.8	26.8	35.4	31.3	19.9	15.4	15.5	10.7	8.1	16.1	18.1	217.0
Bhilwara	8.5	10.8	18.8	26.4	35.0	29.7	18.1	12.9	14.2	10.6	8.3	13.8	17.3	207.1
Bikaner	7.8	10.3	18.8	27.2	34.9	31.9	24.9	21.3	17.2	11.0	7.5	20.0	19.4	232.8
Bundi	8.6	10.9	19.6	27.9	37.1	31.4	18.5	12.3	14.5	10.9	8.4	13.7	17.8	213.8
Chittaurgarh	8.7	10.9	18.5	26.1	34.5	29.0	17.0	11.9	13.7	10.5	8.4	13.0	16.8	202.2
Churu	7.0	9.5	17.6	26.2	33.1	28.9	21.7	19.3	15.4	9.7	6.7	18.0	17.8	213.1
Dausa	8.2	11.3	19.3	27.1	36.1	32.6	20.0	15.3	16.2	11.1	8.5	16.7	18.5	222.3
Dhaulpur	8.5	11.1	18.8	26.8	35.6	31.2	19.6	14.8	15.2	10.7	8.2	15.6	18.0	216.1
Dungarpur	9.2	10.8	18.1	26.0	36.0	31.4	19.6	13.1	13.9	11.2	9.4	13.6	17.7	212.4
Ganganagar	5.9	8.2	15.2	23.1	30.8	28.1	22.0	19.8	14.3	8.6	5.9	17.1	16.6	198.9
Hanumangarh	6.2	8.5	15.8	23.9	31.4	28.1	21.5	19.3	14.5	8.9	6.1	17.1	16.8	201.3
Jaipur	8.2	11.4	19.4	27.2	36.2	33.0	20.2	15.6	16.5	11.2	8.6	17.2	18.7	224.6
Jaisalmer	10.8	13.4	23.2	32.4	38.8	34.7	29.7	25.1	21.0	14.0	10.1	23.6	23.1	276.8
Jalore	8.3	10.1	17.1	23.5	31.2	26.7	19.0	14.8	14.5	10.4	8.0	14.7	16.5	198.4
Jhalawar	8.8	11.0	19.0	26.8	35.8	30.4	17.9	12.0	14.2	10.9	8.6	13.3	17.4	208.7
Jhunjhunu	7.1	9.7	17.8	26.3	33.4	29.1	21.1	18.4	15.4	9.8	6.9	17.6	17.7	212.8
Jodhpur	10.0	12.5	21.5	29.6	37.4	33.0	24.2	19.2	17.6	12.4	9.4	18.4	20.4	245.2

District	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Monthly Mean	Annual
Karauli	8.4	11.2	19.1	27.1	35.9	31.8	19.6	14.7	15.5	10.9	8.3	15.8	18.2	218.2
Kota	8.6	10.9	19.6	28.1	37.4	31.4	18.4	12.1	14.4	10.9	8.4	13.6	17.8	213.9
Nagaur	8.4	11.0	19.4	27.5	35.5	31.4	22.1	17.9	16.3	11.0	8.1	17.6	18.8	226.1
Pali	8.0	10.2	18.0	25.1	33.5	28.3	18.7	14.4	13.8	9.7	7.5	14.1	16.8	201.4
Pratapgarh	9.4	11.0	18.2	26.0	36.2	31.8	19.7	12.8	13.9	11.4	9.6	13.5	17.8	213.5
Rajsamand	7.9	10.1	17.9	25.5	33.6	27.8	17.3	13.0	13.3	9.5	7.5	13.4	16.4	196.9
Sawai Madhopur	8.4	11.1	19.3	27.3	36.3	32.0	19.4	14.3	15.5	11.0	8.5	15.6	18.2	218.7
Sikar	7.5	10.2	18.2	26.6	34.2	30.2	20.8	17.6	15.7	10.2	7.4	17.4	18.0	216.1
Sirohi	6.7	8.5	15.4	21.6	30.0	24.6	15.8	12.3	11.6	7.9	6.1	12.0	14.4	172.4
Tonk	8.4	11.2	19.4	27.3	36.3	32.0	19.4	14.2	15.6	11.1	8.5	15.6	18.2	218.9
Udaipur	8.2	10.4	18.3	26.4	34.5	28.1	17.1	12.5	13.3	9.7	7.7	13.2	16.6	199.2

Source: IMD monthly dataset (1990-2009)

3.5 Wind Speed

Tables 3.13 and Table 3.14 shows the mean daily wind speed per year and mean daily wind speed per month during the period 1990 to 2009. Wind speed show no significant trend within the 20 years study period.

Table 3.13: Mean Daily Wind Speed per Year, km/hr

Year	Wind Speed, km/hr
1990	5.7
1991	5.1
1992	5.0
1993	4.8
1994	4.6
1995	4.7
1996	4.1
1997	4.9
1998	4.4
1999	5.2
2000	5.3
2001	4.5
2002	6.0
2003	5.2
2004	6.3
2005	5.1
2006	4.8
2007	4.3
2008	4.7
2009	4.5
Mean	4.9
Positive (P) or Negative	N

Year	Wind Speed, km/hr
(N) trend	
Confidence Level	11.1#

Source: IMD Monthly Dataset from 1990 to 2009
# indicates insignificant trend, as the confidence level is less than 90%.

Table 3.14: Mean Daily Wind Speed per Month, km/hr

Month	Wind Speed, km/hr
January	3.2
February	3.9
March	4.5
April	5.3
May	7.4
June	7.9
July	7.0
August	6.0
September	5.0
October	3.0
November	2.3
December	2.4

Source: IMD Monthly Dataset from 1990 to 2009.

Figure 3.15 shows the variation of wind speed over the years 1990 to 2009. Figure 3.16 depicts the mean daily wind speed per month.

Figure 3.15: Daily Means of Wind Speeds from 1990 to 2009, km/hr

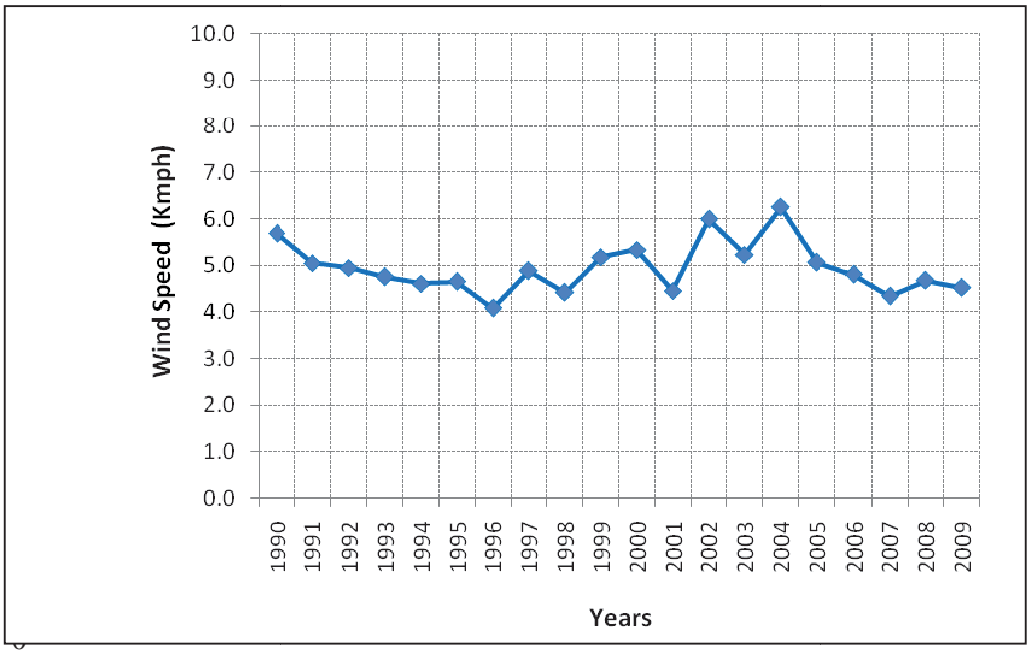
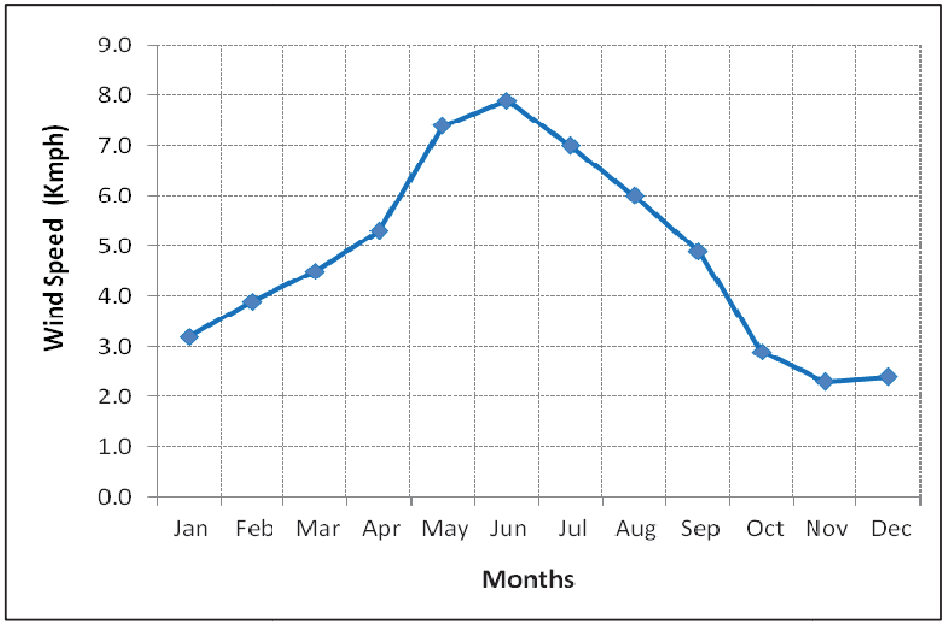


Figure 3.16: Mean Daily Wind Speed per Month, km/hr



3.6 Sunshine Hours

Table 3.15 and Table 3.16 show mean daily and mean monthly daily sunshine hours, respectively. Sunshine hours in Rajasthan range from 7.4 to 8.9 per day, as evaluated over the study period of 20 years, with a mean value of 8.1 hrs/day. Sunshine hours show no significant trend within the period of 20 years from 1990 to 2009.

Table 3.15: Mean Daily Sunshine Hours per Year in Rajasthan, Hrs

Year	Mean Number of Daily Sunshine Hours
1990	8.5
1991	8.9
1992	7.4
1993	8.1
1994	7.4
1995	7.7
1996	8.0
1997	8.3
1998	8.4
1999	8.7
2000	8.2
2001	8.1
2002	8.0
2003	7.6
2004	7.8

Year	Mean Number of Daily Sunshine Hours
2005	8.2
2006	7.8
2007	8.3
2008	7.9
2009	8.3
Mean	8.1
Positive (P) or Negative (N) trend	P
Confidence Level, %	17.0#

# indicates insignificant trend as the confidence level is less than 90%.
Source: IMD Monthly Dataset from 1990 to 2009

Table 3.16: Mean Daily Sunshine Hours per Month

Month	Mean Daily Sunshine Hours
January	7.7
February	8.4
March	8.4
April	9.2
May	9.3
June	8.2
July	6.6
August	6.9
September	8.1
October	8.9
November	8.5
December	7.4
Mean Monthly	8.1

Source: IMD Monthly dataset (1990 - 2009)

Figure 3.17 shows the variation of the annual mean of number of sunshine hours over the years 1990 to 2009. Figure 3.18 shows the variation of the number of sunshine hours between the months in Rajasthan.

Figure 3.17: Mean Daily Sunshine Hours from 1990 to 2009

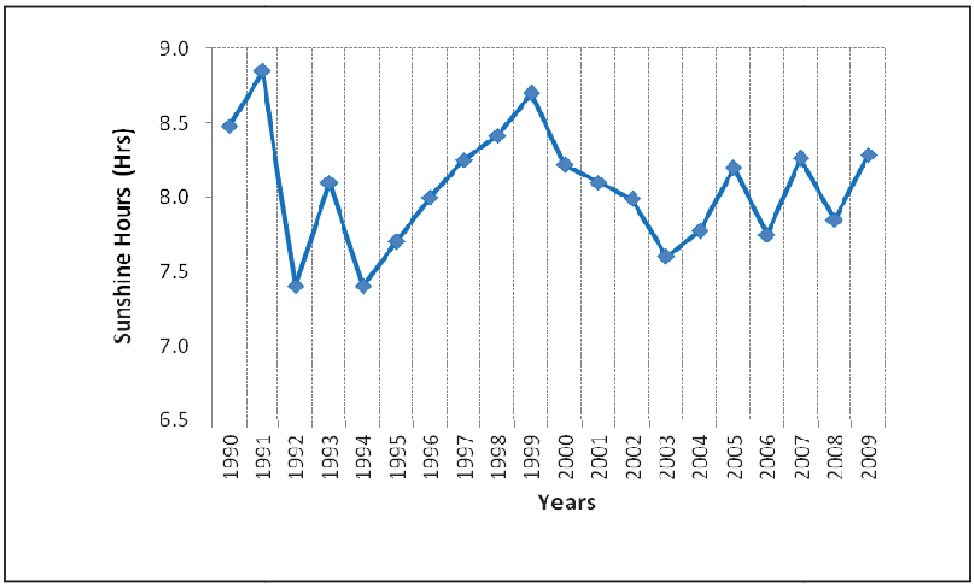
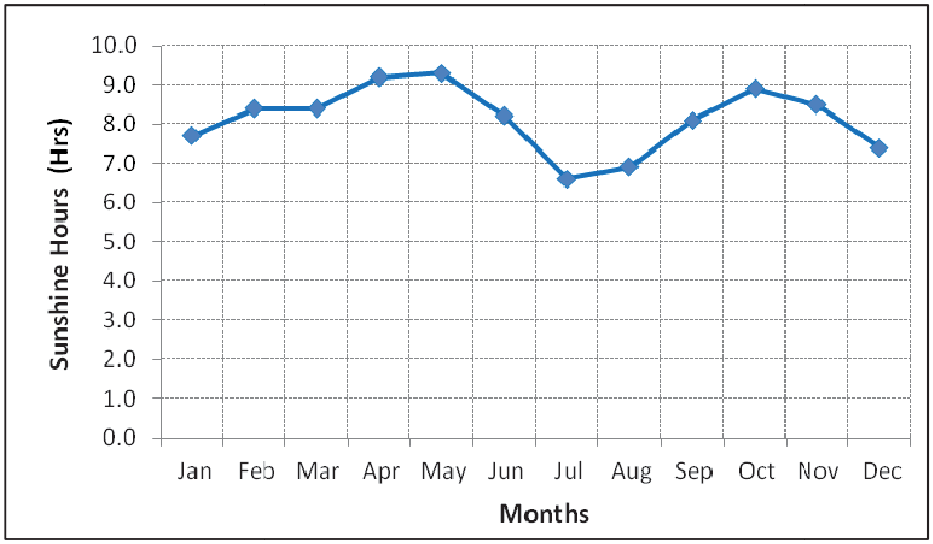


Figure 3.18: Mean Daily Sunshine Hours per Month



3.7 Relative Humidity

Tables 3.17 shows mean daily relative humidity per year in Rajasthan from 1990 to 2009. Table 3.18 shows mean daily relative humidity per month in Rajasthan. Figure 3.19 shows the variation in mean annual relative humidity over the years 1990 to 2009. Relative humidity (RH) in Rajasthan ranges from 46.8 to 57.6%, with a mean value of 50.7%. Figure 3.20 depicts mean daily relative humidity values and its variation over the months. They follow a sinusoidal pattern, decreasing from 54.7% in January to a minimum of 30.5% in April, increasing to a maximum of 72.6% in August, and again decreasing to 48.4% in October. Relative

humidity is lowest in month of April (30.5%) while it is highest in month of August (72.6%).

Relative humidity (RH) in Rajasthan shows no significant trend within the period of 20 years from 1990 to 2009.

Table 3.17: Mean Daily Relative Humidity per Year, %

Year	Mean Relative Humidity, %
1990	52.1
1991	48.7
1992	51.0
1993	50.5
1994	52.0
1995	51.1
1996	52.1
1997	57.6
1998	54.3
1999	50.1
2000	47.9
2001	51.0
2002	46.8
2003	50.9
2004	49.0
2005	49.7
2006	51.3
2007	51.0
2008	50.5
2009	47.1
Mean	50.7
Positive (P) or Negative (N) trend	N
Confidence Level, %	69.0#

# indicates insignificant trend as the confidence level is less than 90%.
Source: IMD Monthly dataset (1990 - 2009)

Table 3.18: Mean Daily Relative Humidity per Month

Month	Mean Daily RH, %
January	54.7
February	47.9
March	38.2
April	30.5
May	35.1
June	48.4
July	67.7
August	72.6

Month	Mean Daily RH, %
September	64.7
October	48.4
November	48.6
December	54.6
Mean	50.9

Source: IMD Monthly dataset (1990-2009).

Figure 3.19: Mean Daily Relative Humidity in % per Year, 1990 - 2009

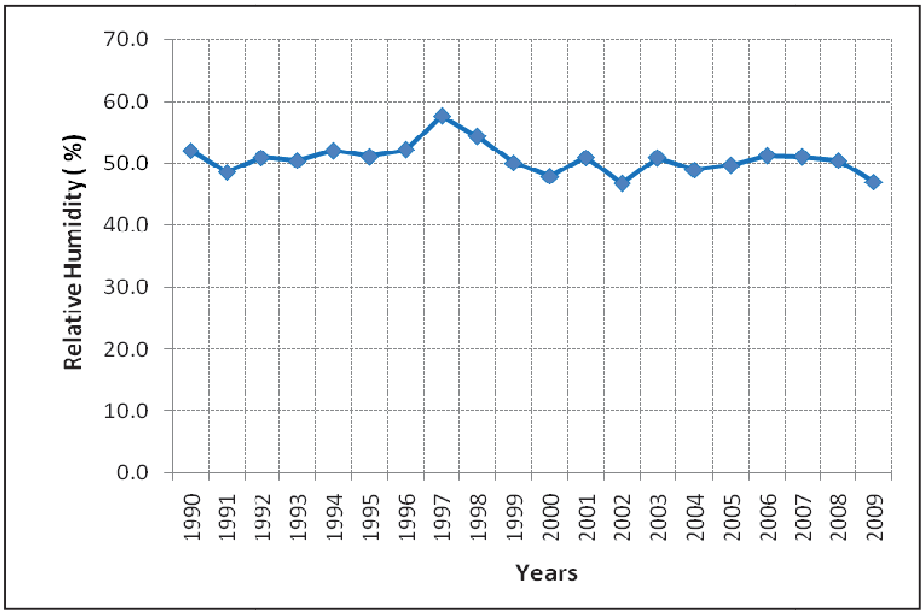
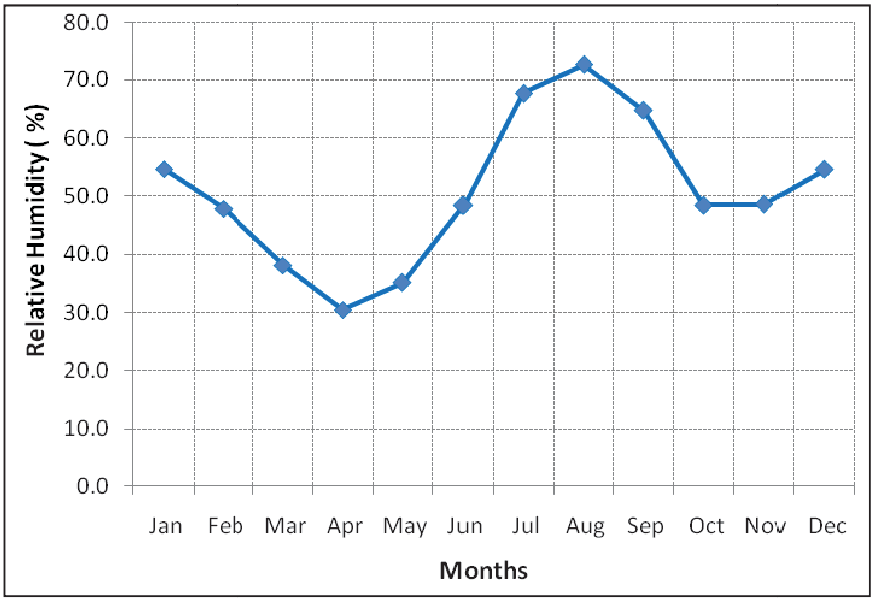


Figure 3.20: Mean Daily Relative Humidity per Month



The spatial variation of Evaporation, Wind Speed, Sunshine Hours and Relative Humidity across Rajasthan is shown in Figure 3.21, Figure 3.22, Figure 3.23 and Figure 3.24 respectively.

3.8 Impact of change of various weather parameters on State as a whole

From the state wise analysis of different weather parameters presented above, it is seen that there is increasing trends in temperature which shall have varied impacts on the already stressed water resources of the State but on the other hand at some places there is increasing trend in rainfall. So in general it can be said that the above two parameters shall compensate each other.

During the present study impact of change in different weather parameters have been studied Agro-Climatic Zone wise as per ToR and presented in Final Report No. 4.1 on "Agroclimatic Zone-wise Hydrology and Weather". The main aspects and outcomes of this report are presented in following sections.

3.9 Summary of Agroclimatic Zone-wise Analysis of Weather Trends

3.9.1 Methodology

A trend analysis was performed by the Consultants using Mann Kendall statistics, which is a non-parametric trend statistic. Kendall's Tau was calculated for monotonic trends, which makes no assumptions about the distribution of the data or the linearity of any trends (Hollander and Wolfe, 1973 6). This statistic is also robust in the face of outliers. The Mann Kendall test has two parameters of importance for trend detection. These are the significance level, which indicates the test strength (p), and the value of Tau, which indicates the direction as well as the strength of the trend. Kendall's Tau is a measure of correlation; it measures the strength of association between the two variables. Kendall's Tau takes values between +1 and -1. A positive correlation indicates that ranks of both the variables increase together while a negative correlation indicates that as the rank of one variable increases while that of the other one decreases.

In hypothesis testing, the significance level is the criterion used for rejecting the null hypothesis. The significance level is used in hypothesis testing as follows:
first, the difference between the results of the experiment and the null hypothesis is determined;

then, assuming the null hypothesis is true, the probability of a difference being large or larger is computed;

finally, this probability is compared to the significance level; if the probability is less than or equal to the significance level, then the null hypothesis is rejected and the outcome is said to be statistically significant.

The significance level is presented here as a confidence level, which is computed by: confidence level = (1-significance level) × 100.

If the probability of occurring of an event is greater than or equal to the confidence level the outcome is said to be statistically significant. In this study trend is said to be significant only if confidence level is greater than 90%.

3.9.2 Results

ACZ Ia

Results of the temporal trend analysis of various weather parameters of ACZ Ia, Arid Western Zone, within the study period of 20 years (1990-2009) are summarized in the following table.

Weather Parameter	Trend	Remarks
Number of rainy days*	No significant trend	
Rainfall in June*	No significant trend	
Rainfall in July*	No significant trend	
Rainfall in August*	No significant trend	
Rainfall in September*	No significant trend	
Evaporation	No significant trend	
Relative Humidity	Significant trend	Decreasing
Sunshine Hours	No significant trend	
Mean Maximum Temperature	No significant trend	
Mean Minimum Temperature	No significant trend	
Highest Maximum Temperature	Significant trend	Decreasing
Lowest minimum Temperature	No significant trend	
Wind Speed	Significant trend	Decreasing

* Number of rainy days and Monsoon Rainfall trends were performed with rainfall data of 54 years (1957-2010)

ACZ Ib

Results of the temporal trend analysis of various weather parameters of ACZ Ib, Irrigated Northwestern Plain within the study period of 20 years (1990-2009) are summarized in the following table.

Weather Parameter	Trend	Remarks
Number of rainy days*	No significant trend	
Rainfall in June*	Significant trend	Increasing
Rainfall in July*	No significant trend	
Rainfall in August*	No significant trend	
Rainfall in September*	No significant trend	
Evaporation	Significant trend	Decreasing
Relative Humidity	No Significant trend	
Sunshine Hours	Significant trend	Decreasing
Mean Maximum Temperature	No significant trend	
Mean Minimum Temperature	Significant trend	Increasing
Highest Maximum Temperature	No significant trend	
Lowest minimum Temperature	No significant trend	

Weather Parameter	Trend	Remarks
Wind Speed	Significant trend	Decreasing

* Number of rainy days and Monsoon Rainfall trends were performed with rainfall data of 54 years (1957-2010)

ACZ Ic

Results of the temporal trend analysis of various weather parameters of ACZ Ic, Hyper Arid Irrigated Western Plain (Partially), within the study period of 20 years (1990-2009) are summarized in the following table.

Weather Parameter	Trend	Remarks
Number of rainy days*	No significant trend	
Rainfall in June*	Significant trend	Increasing
Rainfall in July*	No significant trend	
Rainfall in August*	No significant trend	
Rainfall in September*	No significant trend	
Evaporation	No significant trend	
Relative Humidity	No significant trend	
Sunshine Hours	Significant trend	Decreasing
Mean Maximum Temperature	No significant trend	
Mean Minimum Temperature	Significant trend	Increasing
Highest Maximum Temperature	Significant trend	Decreasing
Lowest minimum Temperature	Significant trend	Increasing
Wind Speed	No significant trend	

* Number of rainy days and Monsoon Rainfall trends were performed with rainfall data of 54 years (1957-2010)

ACZ IIa

Results of the temporal trend analysis of various weather parameters of ACZ IIa, Transitional Plain of Inland Drainage, within the study period of 20 years (1990-2009) are summarized in the following table.

Weather Parameter	Trend	Remarks
Number of rainy days*	No significant trend	
Rainfall in June*	Significant trend	Increasing
Rainfall in July*	No significant trend	
Rainfall in Aug*	No significant trend	
Rainfall in September*	No significant trend	
Evaporation	Significant trend	Decreasing
Relative Humidity	No significant trend	
Sunshine Hours	Data not available	
Mean Maximum Temperature	Significant trend	Increasing
Mean Minimum Temperature	No significant trend	
Highest Maximum Temperature	No significant trend	
Lowest minimum Temperature	No significant trend	
Wind Speed	No significant trend	

* Number of rainy days and Monsoon Rainfall trends were performed with rainfall data of 54 years (1957-2010)

ACZ IIb

Results of the temporal trend analysis of various weather parameters of ACZ IIb, Transitional Plain of Luni Basin, within the study period of 20 years (1990-2009) are summarized in the following table.

Weather Parameter	Trend	Remarks
Number of rainy days*	No significant trend	
Rainfall in June*	No significant trend	
Rainfall in July*	No significant trend	
Rainfall in August*	No significant trend	
Rainfall in September*	No significant trend	
Evaporation	No significant trend	
Relative Humidity	Significant trend	Decreasing
Sunshine Hours	Data not available	
Mean Maximum Temperature	Significant trend	Increasing
Mean Minimum Temperature	No significant trend	
Highest Maximum Temperature	No significant trend	
Lowest minimum Temperature	Significant trend	Increasing
Wind Speed	No significant trend	

* Number of rainy days and Monsoon Rainfall trends were performed with rainfall data of 54 years (1957-2010)

ACZ IIIa

Results of the temporal trend analysis of various weather parameters of ACZ IIIa, Semi Arid Eastern Plain, within the study period of 20 years (1990-2009) are summarized in the following table.

Weather Parameter	Trend	Remarks
Number of rainy days*	No significant trend	
Rainfall in June*	No significant trend	
Rainfall in July*	No significant trend	
Rainfall in August*	No significant trend	
Rainfall in September*	No significant trend	
Evaporation	No significant trend	
Relative Humidity	No significant trend	
Sunshine Hours	No significant trend	
Mean Maximum Temperature	Significant trend	Increasing
Mean Minimum Temperature	No significant trend	
Highest Maximum Temperature	No significant trend	
Lowest minimum Temperature	No significant trend	
Wind Speed	No Significant trend	

* Number of rainy days and Monsoon Rainfall trends were performed with rainfall data of 54 years (1957-2010)

ACZ IIIb

Results of the temporal trend analysis of various weather parameters of ACZ IIIb, Flood Prone Eastern Plain, within the study period of 20 years (1990-2009) are summarized in the following table.

Weather Parameter	Trend	Remarks
Number of rainy days*	No significant trend	
Rainfall in June*	Significant trend	Increasing
Rainfall in July*	No significant trend	
Rainfall in August*	Significant trend	Decreasing
Rainfall in September*	No significant trend	
Evaporation	Data not available	
Relative Humidity	Significant trend	Increasing
Sunshine Hours	Data not available	
Mean Maximum Temperature	Significant trend	Decreasing
Mean Minimum Temperature	No significant trend	
Highest Maximum Temperature	Significant trend	Decreasing
Lowest minimum Temperature	No significant trend	
Wind Speed	Data not available	

* Number of rainy days and Monsoon Rainfall trends were performed with rainfall data of 54 years (1957-2010)

ACZ IVa

Results of the temporal trend analysis of various weather parameters of ACZ IVa, Sub-Humid Southern Plain, within the study period of 20 years (1990-2009) are summarized in the following table.

Weather Parameter	Trend	Remarks
Number of rainy days*	No significant trend	
Rainfall in June*	No significant trend	
Rainfall in July*	Significant trend	Increasing
Rainfall in August*	No significant trend	
Rainfall in September*	No significant trend	
Evaporation	No Significant trend	
Relative Humidity	No significant trend	
Sunshine Hours	Data not available	
Mean Maximum Temperature	Significant trend	Increasing
Mean Minimum Temperature	Significant trend	Increasing
Highest Maximum Temperature	No significant trend	
Lowest minimum Temperature	Significant trend	Increasing
Wind Speed	No significant trend	

* Number of rainy days and Monsoon Rainfall trends were performed with rainfall data of 54 years (1957-2010)

ACZ IVb

Results of the temporal trend analysis of various weather parameters of ACZ IVb, Humid Southern Plain, within the study period of 20 years (1990-2009) are summarized in the following table.

Weather Parameter	Trend	Remarks
Number of rainy days*	No significant trend	
Rainfall in June	No significant trend	
Rainfall in July	Significant trend	Increasing
Rainfall in August	No significant trend	
Rainfall in September	No significant trend	
Evaporation	No significant trend	
Relative Humidity	No significant trend	
Sunshine Hours	Data not available	
Mean Maximum Temperature	No significant trend	
Mean Minimum Temperature	No significant trend	
Highest Maximum Temperature	Significant trend	Decreasing
Lowest minimum Temperature	No significant trend	
Wind Speed	Data not available	

* Number of rainy days and Monsoon Rainfall trends were performed with rainfall data of 54 years (1957-2010)

ACZ V

Results of the temporal trend analysis of various weather parameters of ACZ V, Humid Southeastern Plain, within the study period of 20 years (1990-2009) are summarized in the following table.

Weather Parameter	Trend	Remarks
Number of rainy days*	No significant trend	
Rainfall in June*	No significant trend	
Rainfall in July*	No significant trend	
Rainfall in August*	Significant trend	Decreasing
Rainfall in September*	No significant trend	
Evaporation	No significant trend	
Relative Humidity	No significant trend	
Sunshine Hours	Data not available	
Mean Maximum Temperature	No significant trend	
Mean Minimum Temperature	Significant trend	Increasing
Highest Maximum Temperature	Significant trend	Decreasing
Lowest minimum Temperature	Significant trend	Increasing
Wind Speed	No Significant trend	

* Number of rainy days and Monsoon Rainfall trends were performed with rainfall data of 54 years (1957-2010)

3.10 Impact of Change in Weather and Future Strategies

3.10.1 Impact of Change in Weather Parameters on Cropping Pattern, Productivity and Water Resources

Trend analysis shows that there is a significant positive trend in the both mean maximum temperature and minimum temperature, thereby increasing the concern for crops and water conservation. Increased temperature may shorten the length of growing periods and increase in crop water demand resulting in reduction of yield. Increase in evaporation may affect the open water bodies or storage structures. Increase in temperature with long period of dry spells may affect the soil moisture status leading to drought like situation.

Based on the results of temporal trend analysis of various weather parameters the impacts on cropping pattern, productivity and water resources for various Agroclimatic zones are given below.

ACZ Ia

- Three entities namely, highest maximum temperature, wind speed and relative humidity show decreasing trend in this ACZ.
- The possible impact of this trend can be reduction in the evapotranspiration and thereby the crop water requirements in this ACZ. The prevailing cropping pattern bajra in kharif and mustard and isabgol in rabi may not have significant change however productivity of crops may be affected negatively.
- This shall also imply that there is a general improvement in the water resource availability in this ACZ, which can be used for storage by constructing water harvesting structures.

ACZ Ib

- Three entities namely, highest maximum temperature, wind speed and relative humidity show decreasing trend whereas two of the entities i.e., rainfall of June and mean minimum temperature show increasing trend in this ACZ.
- The possible impact of the decreasing trend in the highest maximum temperature, wind speed and relative humidity can be reduction in the evapotranspiration and thereby the crop water requirements. This will have less impact on prevailing cropping pattern jawar and guar in kharif and mustard and wheat in rabi however productivity of crops may be affected negatively.
- The increase in the rainfall of June can be useful but this advantage may be lost due to the increase in the mean minimum temperature that shall result in increase in the evapotranspiration in this ACZ. However, for a specific crop the ET might not increase since the higher temperature shall result in reduced ET because of the reduction in the crop growth period and thereby the effective crop ET.
- The overall likely impact on the water resources of the ACZ shall be almost not much change overall since there is some increase in the precipitation but the impact shall be compensated by the increased ET demand.

ACZ Ic

- Two entities i.e. highest maximum temperature and sunshine hours show decreasing trend while three entities i.e. rainfall of June, mean minimum temperature and lowest minimum temperature show increasing trend in this ACZ.

- The possible impact of the decreasing trend in the highest maximum temperature and sunshine hours can be reduction in the evapotranspiration and thereby the crop water requirements. This will have less impact on prevailing cropping pattern guar and bajra in kharif and gram in rabi but productivity of crops may decline.
- The increase in the rainfall of June can be useful but this advantage may be lost due to the increase in the mean minimum and the lowest minimum temperature that shall result in increase in the evapotranspiration in this ACZ. However, for a specific crop the ET might not increase since the higher temperature shall result in reduced ET because of the reduction in the crop growth period and thereby the effective crop ET.
- This shall also imply that there is a general improvement in the water resource availability in this ACZ.

ACZ IIa

- There is an increasing trend in rainfall of June and mean minimum temperature in this ACZ.
- A decreasing trend in evaporation has been observed for this ACZ. This will have less impact on prevailing cropping pattern bajra in kharif and wheat and gram in rabi.
- The decreasing trend in the evaporation can be on account of the changes in many other weather parameters (though not significant individually) that in turn influence evaporation.
- The increase in the rainfall of June can be useful but this advantage may be negated due to the increase in the mean minimum temperature that shall result in increase in the evapotranspiration in this ACZ. However, for a specific crop the ET might not increase since the higher temperature shall result in reduced ET because of the reduction in the crop growth period and thereby the effective crop ET.
- The overall likely impact on the water resources of the ACZ shall be almost not much change overall since there is some increase in the precipitation but the impact shall be compensated by the increased ET demand.

ACZ IIb

- Two entities i.e. mean maximum temperature and lowest minimum temperature shows increasing trend while relative humidity shows decreasing trend in this ACZ.
- Possible impact of increased mean maximum and lowest minimum temperature along with reduced relative humidity shall be enhanced evapotranspiration and thus lowering of the crop durations. This might entail reduction in crop yields. Prevailing cropping pattern bajra, maize and sesamum in kharif and mustard and wheat may not have significant impact.
- This shall also imply that there is a general reduction in the water resource availability in this ACZ.

ACZ IIIa

- Only one entity shows significant trend i.e. mean maximum temperature, which shows increasing trend in this ACZ.
- Possible impact of increased mean maximum temperature shall be enhanced evapotranspiration and thus lowering of the crop durations. This might entail

reduction in crop yields however prevailing cropping pattern jowar and bajra in kharif and wheat in rabi may not have significant impact.

- This shall also imply that there is a general reduction in the water resource availability in this ACZ.

ACZ IIIb

- Two entities i.e. rainfall in June and relative humidity shows increasing trend while three entities i.e. rainfall in August, mean maximum temperature and highest maximum temperature shows decreasing trend in this ACZ.
- The combined effect of reduced temperature and increased relative humidity shall be reduction in evapotranspiration. This will have an impact on prevailing cropping pattern of bajra in kharif and mustard and wheat in rabi as the bajra cropping may reduce similarly productivity of crops may also be affected negatively.
- The increase in June rainfall can be beneficial for the timely sowing and reduced evapotranspiration can result in slight improvement in the crop yields (of course depending on many other factors such as crop species etc.).
- This shall also imply that there is a general improvement in the water resource availability in this ACZ.

ACZ IVa

- Four entities i.e. rainfall in July, mean maximum temperature, mean minimum temperature and lowest minimum temperature shows increasing trend in this ACZ.
- Resultant effect could be increase in evapotranspiration with reduction in crop duration. This will lead to early maturity and reduction in crop yield. Prevailing cropping pattern maize and soybean in kharif and wheat in rabi will not be significantly affected.
- The overall likely impact on the water resources of the ACZ shall be almost not much change overall since there is some increase in the precipitation but the impact shall be compensated by the increased ET demand.

ACZ IVb

- In this ACZ one entity i.e. rainfall in July shows increasing trend while highest maximum temperature shows decreasing trend.
- This can be beneficial with reduced evapotranspiration and increased crop yield, prevailing cropping pattern of maize and soybean in kharif and wheat in rabi will not be significantly affected.
- This shall also imply that there is a general improvement in the water resource availability in this ACZ.

ACZ V

- In this ACZ two entities i.e. rainfall in August and highest maximum temperature shows decreasing trend while two entities i.e. mean minimum temperature and lowest minimum temperature shows increasing trend.
- Evapotranspiration will increase to some extent, but might need supplementary irrigation due to decreasing rainfall in August. Cropping pattern of soybean and bajra in kharif and mustard, wheat and coriander in rabi will not be significantly affected however, crops productivity may be affected.
- This shall also imply that there is a general reduction in the water resource availability in this ACZ.

3.10.2 ACZ wise futuristic strategies in view of change in weather

Based on the weather analysis and referring to the District contingency plan, Climate resilient technologies developed by NICRA (National Initiative on Climate Resilient Agriculture) the following inferences are drawn:

ACZ Ia

- The prevailing cropping pattern of bajra in kharif and mustard and isabgol in rabi shall continue to fulfill the future needs.
- Use of sprinkler irrigation for major crops. Considering significant production of vegetables and fruits from this ACZ, drip irrigation is recommended for vegetables and fruits.
- Water harvesting structures be constructed with larger catchment area.
    - Rainwater harvesting through improved tanks and nadi.
    - Roof water harvesting.
    - In situ moisture conservation: field/ farm bunds.
- Practicing inter-cropping / mixed cropping.
- Practicing dry land farming system.
- Soil mulching.
- Harvesting the crops for fodder in case of drought.
- Promotion of perennial component (agro-forestry).

ACZ Ib

- The prevailing cropping pattern of jowar and guar in kharif and mustard and wheat in rabi needs to be continued to cater the future needs.
- Apply crop and soil management practices to harness the water during excess rainfall.
- Use of sprinkler irrigation.
- Water harvesting structures be constructed with larger catchment area.
    - Rainwater harvesting through improved tankas and nadi.
    - Roof water harvesting.
    - In situ moisture conservation: field/ farm bunds.

ACZ Ic

- The prevailing cropping pattern of guar and bajra in kharif and gram in rabi shall continue with increased area of guar compensating area of bajra in kharif.
- Apply crop and soil management practices to harness the water in excess rainfall.
- Cultural and management practices that reduce canopy temperature during the seasons with higher air temperatures.
- Strategies for reducing the warming effect over the area by improving vegetative cover and creating sink for greenhouse gases.
- Use of sprinkler irrigation.
- Water harvesting structures be constructed with larger catchment area.
    - Rainwater harvesting through improved tankas and nadi.
    - Roof water harvesting.

- In situ moisture conservation: field/ farm bunds.

ACZ IIa

- The prevailing cropping pattern of bajra in kharif and wheat and gram in rabi shall continue to fulfill future needs.
- Water harvesting structures be constructed with larger catchment area.
  - Rainwater harvesting through improved tankas and nadi.
  - Roof water harvesting.
  - In situ moisture conservation: field/ farm bunds.
- Cultural and management practices that reduce canopy temperature during the seasons with higher air temperatures.
- Strategies for reducing the warming effect over the area by improving vegetative cover and creating sink for greenhouse gases.
- Apply crop and soil management practices to harness the water in excess rainfall.
- Use of sprinkler irrigation for major crops. Considering significant production of vegetables and fruits from this ACZ, drip irrigation is recommended for vegetables and fruits.

ACZ IIb

- Prevailing cropping pattern of bajra, maize and sesamum in kharif and mustard and wheat in rabi shall continue with increased area of sesamum compensating maize in kharif to fulfill the future requirements.
- Summer ploughing for conserving moisture in the soil.
- Water harvesting tank for terminal drought life saving irrigation.
- Early maturing varieties should be sown.
- Cultural and management practices that reduce canopy temperature during the seasons with higher air temperatures.
- Strategies for reducing the warming effect over the area by improving vegetative cover and creating sink for greenhouse gases.
- Inter culture operation for moisture conservation.
- Use of sprinkler irrigation.

ACZ IIIa

- Prevailing cropping pattern of jowar and bajra in kharif and wheat in rabi shall continue with increased area of bajra compensating jowar in kharif to fulfill future needs.
- Cultural and management practices that reduce canopy temperature during the seasons with higher air temperatures.
- Strategies for reducing the warming effect over the area by improving vegetative cover and creating sink for greenhouse gases.
- Hoeing & weeding to conserve moisture.
- Use of sprinkler irrigation for major crops. Considering significant production of vegetables and fruits from this ACZ, drip irrigation is recommended for vegetables and fruits.

ACZ IIIb

- The prevailing cropping pattern of bajra in kharif and mustard and wheat in rabi shall continue to fulfill the future requirements.
- Apply crop and soil management practices to harness the water in June month when there is an increase in rainfall and harvest it during August month when the rainfall is showing a decreasing trend.
- Water harvesting structures be constructed with larger catchment area.
    - Roof water harvesting.
    - Renovation of defunct rainwater harvesting structure.
- Use of sprinkler irrigation.

ACZ IVa

- Prevailing cropping pattern of maize and soybean in kharif and wheat in rabi shall continue to fulfill the future needs.
- Cultural and management practices that reduce canopy temperature during the seasons with higher air temperatures.
- Use of sprinkler irrigation for major crops. Considering significant production of vegetables and fruits from this ACZ, drip irrigation is recommended for vegetables and fruits.
- Strategies for reducing the warming effect over the area by improving vegetative cover and creating sink for greenhouse gases.
- Inter culture operation for moisture conservation.
- Apply crop and soil management practices to harness the water in excess rainfall in the month of July.
- Water harvesting structures be constructed with larger catchment area.
    - Rainwater harvesting through improved tankas and nadi.
    - Roof water harvesting.
    - In situ moisture conservation: field/ farm bunds.

ACZ IVb

- The prevailing cropping pattern of maize and soybean in kharif and wheat in rabi shall continue to cater the future requirements.
- Crop and soil management practices can be applied to harness excess water in the month of July.
- Use of sprinkler irrigation.
- Water harvesting structures be constructed with larger catchment area.
    - Rainwater harvesting through improved tankas and nadi.
    - Roof water harvesting.
    - In situ moisture conservation: field/ farm bunds.

ACZ V

- Cropping pattern of soybean and bajra in kharif and mustard, wheat and coriander shall continue.
- Rainwater harvesting structures: farm ponds, percolation ponds should be constructed.

- Renovation of defunct community rainwater harvesting structures.
- In situ moisture conservation: broad bed furrow, deep ploughing in summer, bunding of field.
- Recycling of organic matter through pit composting and vermi-composting.
- Use of sprinkler irrigation.

Agroclimatic zone-wise summary of recommendations for irrigation methods considering different weather parameters and cropping pattern is presented in Table 3.19.

Table 3.19: Agroclimatic Zone-wise Summary of Recommendations for Irrigation Methods

Agro-climatic Zone		Mean Daily Wind Speed, km/hr			Mean Daily Relative Humidity, %			Mean Annual Total Evaporation, cm			Mean Daily Maximum Temperature, °C				Mean Daily Minimum Temperature, °C			Mean Annual Rainfall, mm			Cropping Pattern (Major Crops)		Recommendations
		Min.	Max.	Mean	Min.	Max.	Mean	Min.	Max.	Mean	Min.	Max.	Mean	High. Max.	Min.	Max.	Mean	Min.	Max.	Mean	Kharif	Rabi	
Ia	Arid Western	3.3	8.1	5.2	43.9	52.3	47.4	206.9	264.4	232.9	32.8	35.0	34.2	46.4	18.3	20.9	19.5	86.4	567.4	270.2	Bajra	Isabgol, Mustard	Use of sprinkler irrigation for major crops. Considering significant production of vegetables and fruits from this ACZ, drip irrigation is recommended for vegetables and fruits.
Ib	Irrigated North Western Plain	3.2	5.3	4.1	46.9	57.7	52.9	174.1	222.7	194.3	33.1	34.1	33.5	46.9	18.1	19.4	18.5	110.6	459.3	244.0	Jowar, Guar	Wheat, Mustard	Use of sprinkler irrigation.
Ic	Hyper Arid Irrigated Western Plain Partially	4.4	10.1	6.5	43.5	50.7	46.9	199.7	306.7	247.5	33.6	34.7	34.1	46.4	18.2	20.4	19.5	70.1	501.5	281.4	Guar, Bajra	Gram, Wheat	Use of sprinkler irrigation.
IIa	Transitional Plain of inland drainage	3.6	6.1	4.7	43.8	55.6	48.8	199.3	242.0	214.1	32.6	34.3	33.4	46.3	17.3	20.6	18.9	188.6	819.2	439.4	Bajra	Wheat, Mustard	Use of sprinkler irrigation for major crops. Considering significant production of vegetables and fruits from this ACZ, drip irrigation is recommended for vegetables and fruits.
IIb	Transitional Plain of Luni Basin	1.9	5.5	3.8	44.7	61.4	52.0	141.1	251.4	199.0	25.9	34.6	32.8	44.5	12.0	20.3	18.4	108.2	1060.0	412.2	Bajra, Maize, Sesamum	Mustard, Wheat	Use of sprinkler irrigation.
IIIa	Semi-Arid Eastern Plain	1.6	7.6	5.3	43.5	53.7	48.5	205.8	228.1	218.3	32.4	33.2	32.8	44.3	18.4	20.7	19.6	205.9	841.8	518.7	Jowar, Bajra	Mustard, Wheat	Use of sprinkler irrigation for major crops. Considering significant production of vegetables and fruits from this ACZ, drip irrigation is recommended for vegetables and fruits.
IIIb	Flood Prone Eastern Plain	2.0	6.1	4.4	49.4	55.9	52.5	209.4	224.0	216.7	32.7	33.9	33.2	47.1	18.2	19.4	19.2	284.6	1027.4	618.7	Bajra	Mustard, Wheat	Use of sprinkler irrigation.
IVa	Sub humid Southern Plain	2.3	8.5	4.8	47.1	61.5	52.5	148.8	217.5	197.9	25.9	33.2	32.3	42.1	12.0	20.2	18.2	310.7	1174.0	615.5	Maize, Soybean	Wheat, Mustard	Use of sprinkler irrigation for major crops. Considering significant production of vegetables and fruits from this ACZ, drip irrigation is recommended for vegetables and fruits.
IVb	Humid southern Plain	4.6	7.2	5.1	51.5	54.2	53.3	201.2	222.9	214.3	31.8	33.6	33.0	45.0	17.8	20.8	19.6	363.1	1657.6	782.8	Maize, Soybean	Wheat, Mustard	Use of sprinkler irrigation.
V	Humid South-Eastern Plain	1.4	6.5	4.3	44.1	55.1	51.2	189.5	218.3	206.6	31.8	33.2	32.6	46.3	19.1	21.9	19.9	371.7	1254.7	773.4	Soybean, Bajra	Wheat, Mustard	Use of sprinkler irrigation.

NOTE:

The mean daily wind velocity in various agroclimatic zones of Rajasthan State varies from 1.0 to 13.0 km/hr. During the Rabi season (November to March), mean daily wind velocity ranges from 1.0 to 6.1 km/hr. The literature shows that sprinklers are not found suitable for wind velocities over 16 km/hr. As per the observed wind velocities in different agroclimatic zones during the year sprinklers can be used for all agroclimatic zones of Rajasthan.

It is to be pointed out that above recommendations are being proposed considering the major crops of Rabi season as well as production of vegetables and fruits from the particular agroclimatic zone.

For the design of sprinkler irrigation system for specific area / agroclimatic zone a detailed study is required to determine the pressure range, diameter of nozzles, spacing and area of coverage.

Important References:

1. Sprinkler Systems Design Guide, Netafim USA (http://www.netafimusa.com/files/literature/greenhouse/G221-Sprinkler-Design-Guide.pdf)
2. Potential for Drip and Sprinkler Irrigation in India, A. Narayanamoorthy
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4. Impact of Drip Irrigation Technology among farmers in Jaipur Region of Rajasthan, R.C. Jitarwal and N. K. Sharma, Indian Res. J. Ext. Edu. 7 (2&3), May & September 2007
5. Jain Irrigation Systems Ltd. (www.jains.com)
6. Efficiency of Irrigation: A Case of Drip Irrigation, Occasional Paper - 45, A. Narayanmoorthy, Department of Economic Analysis and Research, NABARD, Mumbai, 2005
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4. Agroclimatic Zones of Rajasthan

4.1 Introduction

Agroclimatic zoning is mainly based on the type of soil, climate (rainfall etc.), main crops grown and irrigation facilities existing in different parts of the State. To delineate the Agroclimatic Zones (ACZ), the scientists of Indian Council of Agriculture Research and scientists working at various Agriculture Research Stations in the State Department of Agriculture, Rajasthan, are responsible. During the period 1981 to 1993 the National Agriculture Research Project (NARP) categorized Rajasthan as nine Agroclimatic Zones on the basis of soil types, climatic conditions and crop features, for the purpose of micro-level planning.

Later on, during 2008, based upon recommendations of the NARP, ACZ Ic, called Hyper-Arid and Irrigated Western Plain Partially, was delineated as the tenth ACZ, covering all the Tehsils of Bikaner and Jaisalmer Districts and -Sujangarh, Ratangarh, Sardar Shahar Tehsils of Churu Districts. This was done in due consideration of the introduction of surface irrigation.

In accordance with these ACZs, the Department of Agriculture, Rajasthan, has established Adaptive Trial Centres (ATC), one in each ACZ.

The Agroclimatic Zones of Rajasthan are shown in Figure 4.1 along with River Basins of Rajasthan.

Details describing the ACZs are presented in Table 4.1.

Table 4.1: Salient Features of the Agroclimatic Zones of Rajasthan

No.	Agroclimatic Zone	Districts (Blocks)	Area, Million ha.		Rainfall Range, mm	Temperature, °C		Major Crops (2 - 4 No.)		Soils
			Total	Net Sown		Max.	Min.	Kharif	Rabi	
Ia	Arid Western	Part of Barmer (Barmer, Balotra, Baytod, Chohtan, Dhorimanna, Sindhari, Sheo) and Jodhpur (Balesar, Bap, Part of Bhopalgarh, Luni, Mandore, Osian, Phalodi, Shergarh)	4.56	2.34	216-496	40.0	8.0	Pearlmillet, Mothbean, Sesamum	Wheat, Mustard, Cumin	Desert soils and sand dunes aeolian soil, coarse sand in texture some places calcareous
Ib	Irrigated North Western Plain	Ganganagar and Hanumangarh	2.06	1.60	183-344	42.0	4.7	Cotton, Clusterbean	Wheat, Mustard, Gram	Alluvial deposits calcareous, high soluble salts and exchangeable sodium
Ic	Hyper Arid Irrigated Western Plain Partially	Bikaner, Jaisalmer and Part of Churu (Ratangarh, Sardarshahar, Sujangarh)	7.70	2.44	192-420	48.0	3.0	Pearlmillet, Mothbean, Clusterbean	Wheat, Mustard, Gram	Desert soils and sand dunes aeolian soil, Loamy coarse in texture and calcareous
IIa	Transitional Plain of inland drainage	Nagaur, Sikar, Jhunjhunu and Part of Churu (Churu, Rajgarh, Taranagar)	3.71	2.68	266-627	39.7	5.3	Pearlmillet, Clusterbean, Pulses	Wheat, Mustard, Gram	Sandy loam, shallow depth red soils in depressions
IIb	Transitional Plain of Luni Basin	Jalore, Pali, Part of Sirohi (Reodhar, Sheoganj, Sirohi), Barmer (Siwana) and Jodhpur (Bilara, Part of Bhopalgarh)	3.17	1.93	139-1273	38.0	4.9	Pearlmillet, Clusterbean, Sesamum	Wheat, Mustard	Red desert soils in Jodhpur, Jalore and Pali sierozems in Pali and Sirohi
IIIa	Semi arid Eastern Plain	Ajmer, Jaipur, Tonk, Part of Dausa (Bandikui, Dausa, Lalsot, Sikrai)	2.95	1.77	313-694	40.6	8.3	Pearlmillet, Clusterbean, Sorghum	Wheat, Mustard, Gram	Sierozems, eastern part alluvial, west north west lithosols, foot hills, brown soils
IIIb	Flood Prone Eastern Plain	Alwar, Bharatpur, Dhaulpur, Karauli, Part of Dausa (Mahuwa) and Sawai Madhopur (Bamanwas, Bonli, Gangapur)	2.44	1.41	140-736	40.0	8.2	Pearlmillet, Clusterbean, Groundnut	Wheat, Barley, Mustard, Gram	Alluvial prone to water logging, nature of recently alluvial calcareous has been observed
IVa	Sub humid Southern Plain	Bhilwara, Chittaurgarh, Rajsamand, Part of Sirohi (Abu Road, Pindwara), Udaipur (Bargain, Bhinder, Girwa, Gogunda, Kherwara, Kotra, Jhadol,	3.76	0.92	311-1470	38.6	8.1	Maize, Pulses, Sorghum	Wheat, Mustard, Gram	Soil are lithosol at foot hills and alluvial in plains

No.	Agroclimatic Zone	Districts (Blocks)	Area, Million ha.		Rainfall Range, mm	Temperature, °C		Major Crops (2 - 4 No.)		Soils
			Total	Net Sown		Max.	Min.	Kharif	Rabi	
		Mavli, Sarada) and Pratapgarh (Choti Sadri, Pratapgarh)								
IVb	Humid Southern Plain	Dungarpur, Banswara, Part of Udaipur (Salumber) and Pratapgarh (Dhariyawad, Peepalkhunt, Arnod)	1.20	0.57	511-1043	39.0	7.2	Maize, Paddy, Sorghum, Black Gram	Wheat, Mustard , Gram	Predominantly reddish medium texture, well drained calcareous, shallow on hills, deep soil in valleys
V	Humid South-Eastern Plain	Baran, Bundi, Jhalawar, Kota, Part of Sawai Madhopur (Khandar, Sawai Madhopur)	2.69	1.27	452-985	42.6	10.6	Sorghum, Soyabean	Wheat, Mustard	black, of alluvial origin, clay loam,
Total			34.23	16.93						

Source: Rajasthan Agriculture Statistics at a glance 2009-10 and present TAHAL study

4.2 Arid Western Plain (Ia)

This region comprises parts of Barmer District (Barmer, Balotra, Baytod, Chohtan, Dhorimanna, Sindhari and Sheo Blocks) and Jodhpur District (Balesar, Bap, part of Bhopalgarh, Luni, Mandore, Osian, Phalodi, and Shergarh Blocks). This is one of the most arid parts of the State where the annual rainfall, which is quite often erratic, ranges between 216 to 496 mm.

Summer temperatures are always high and the diurnal range even exceeds 20°C. During the day, the summer temperatures may be as high as 49°C but in the night, the temperatures may fall to less than 20°C. In winters, the day temperatures are comparatively higher but the night temperatures may drop drastically. Winters are of short duration, not exceeding two months - December and January.

This is an area of not-so-developed drainage system. Owing to poor rainfall, surface water resources do not exist while ground water resources are often deep and brackish. Natural vegetation is therefore only seasonal. With the first showers in late July, a few grass species grow and shrubs and dwarf trees become green. But, soon after the retreat of the Monsoon in mid September, the vegetation dries up, leaving only a few perennial shrubs and a thin pad of pale grass on the landscape.

Mostly rain-fed crops like bajra, Kharif pulses, guar etc. are grown during the Kharif season. Rabi crops like wheat, rape-seed and mustard are mostly grown with irrigation.

4.3 Irrigated North-Western Plains (Ib)

The entire area of Ganganagar and Hanumangarh Districts is an alluvial and aeolian plain, formed by the river Ghaggar. The Ghaggar channel, even though quite wide at some places, often inundates nearby villages during heavy rainfall in its catchment areas.

The arid part of this region is the northern extension of the Indian Thar Desert, covered with wind-blown sand. Extreme aridity, marked with high summer and low winter temperatures, is its usual climatic characteristic. The annual rainfall ranges between 183 and 344 mm. High-velocity winds blow in summer. The area is rich in agricultural produce on account of a well-developed system of canal irrigation; the large network of Gang Canal and Bhakra Canal, along with the Indira Gandhi Canal, has made the entire area green and productive.

Due to abundance of canal water irrigation, this region has today become the granary of Rajasthan. Amongst the Kharif crops, cotton, sugarcane, groundnuts, guar and pulses are of importance. In the Rabi season, wheat, mustard, gram, vegetables and fruits are produced. Total production and productivity levels of all the crops, are relatively much higher in this zone than other parts of the State.

4.4 Hyper-Arid and Irrigated Western Plain Partially (Ic)

The areas under command of Indira Gandhi canal in the Districts of Jaisalmer, Bikaner and part of Churu (Ratangarh, Sardarshahar, and Sujangarh Blocks) are under agroclimatic zone Ic. This is among the most arid parts of the State. The annual rainfall ranges between 192 and 420 mm and is quite erratic. The rainfall may not only vary from year to year but also fluctuates in the same year. Median dates of commencement-of-sowing rains (CSR) are 15th July in Jaisalmer, 8th July in Bikaner and 30th June in Churu. Summer temperatures may range between 40°C and 42°C during June; temperatures may fall to less than 6°C to 8°C during January. Mean annual potential evapo-transpiration may range between 160 to 200 mm. The duration of winter is generally short, mostly occurring during the months of December and January. Because of low rainfall, local surface water resources do not exist. Ground water is generally deep and brackish. Natural vegetation is generally seasonal. A few grass species come up with the onset of Monsoon. This vegetation dries up by mid September. Rain-fed crops like bajra, guar, Kharif, pulses etc. are generally raised. However, with the availability of canal irrigation water, crops raised are cotton, maize groundnut etc. in Kharif, and wheat, mustard, barley, coriander, taramira and cumin in Rabi season.

4.5 Transitional Plain of Inland Drainage (IIa)

This zone comprises Nagaur, Sikar, Jhunjhunu Districts and part of Churu District (Churu, Rajgarh, and Taranagar blocks). The area is covered with sand dunes and inter-dunal sandy plains. Drainage is not well developed, and streams that flow in the rainy season disappear in sandy fields after covering some distance. Climatically, this zone is slightly better as compared to the adjoining zone of the Arid Western Plain. Rainfall is slightly higher, temperatures in summer months go very high but the winters are very cold. Irrigation is restricted to areas with good groundwater potential.

Bajra, sesamum and Kharif pulses are the main crops of the rainy season. Wheat, barley, mustard and gram are grown as irrigated crops or on conserved soil moisture during Rabi.

4.6 Transitional Plain of Luni Basin (IIb)

This area lies between the Aravalli range and the western arid region. The region encompasses the districts Jalore, Pali, Part of Sirohi District (Reodhar, Sheoganj and Sirohi Block), Barmer District (Siwana Block) and Jodhpur District (Bilara and part of Bhopalgarh Blocks). The region has semi-arid climate with an annual rainfall of 134 to 1273 mm. It is drained by river Luni, which is seasonal and flows only during the rainy season. A number of paleo-channels also exist in this area. The western part of the region is dotted with sand dunes, interspersed in alluvial soil. Luni and its several tributaries, like Sukri, Mithri and Jawai have made this area productive. The climatic conditions are almost the same as in the western arid region, except that the rainfall is slightly higher. The groundwater level is high in the river basins, and has been usefully tapped for irrigation. Vegetation is xerophytic and sparse in the western part, but in the east and on the slopes of the

Aravalli ranges there is mesophytic vegetation in the form of woodlands, open forests and grasslands.

The area produces bajra, maize, guar, sesamum and pulses in the Kharif season. In the Rabi season, wheat, barley and mustard are the dominant crops, especially in irrigated areas.

4.7 Semi-arid Eastern Plain (IIIa)

This region comprises Ajmer, Jaipur and Tonk Districts, and part of Dausa District (Bandikui, Dausa, Lalsot, and Sikrai Blocks). River Banas, with its several tributaries, forms a rich fertile plain.

On the western side, this region is flanked by the low Aravalli hills which extend from south-west to the north-east.

The annual rainfall of the region varies from 313 to 694 mm with an increasing trend towards the east. Summer and winter temperatures are not as extreme as in the arid west. Summer temperatures may reach around 47°C, and in winter the minimum may reach 5°C. Depth to water table varies from 15 to 25 m, but the annual fluctuations are high, especially in the years when the south-west Monsoon fails and the yearly replenishment is low. Surface water sources are scarce and therefore harnessing of groundwater has been increasing at an accelerated pace. Natural vegetation is of the mixed xerophytic and mesophytic type, but owing to heavy felling of trees, the surface mantle has been robbed of its natural wealth. In the total gross cultivated area of this zone, bajra, sorghum and pulses are grown in the Kharif season, and wheat, barley, gram and mustard in the Rabi season. Productivity of all crops in this zone is better than that of the agroclimatic zones to the west of the Aravalli range.

4.8 Flood-Prone Eastern Plains (IIIb)

This region comprises Alwar, Bharatpur, Dhaulpur and Karauli Districts, and part of Dausa District (Mahuwa block) and Sawai Madhopur District (Bamanwas, Bonli, and Gangapur blocks). Except for few low hills which exist in Alwar and Sawai Madhopur Districts, the entire region is a flood plain of Banganga and Gambhir rivers. The region has rich alluvial soils, the fertility of which is replenished every year by flood water of the rivers. In periods of heavy rainfall, the rivers outflow their banks and inundate the surrounding villages.

Climatically, the area is similar to the plains of Banas, but the rainfall is relatively higher in the east, the annual amount being between 140 and 736 mm. Natural vegetation exists on mountain slopes, wetland areas and protected zones, but the excessive plundering of forest wealth has depleted the natural cover. The region produces a variety of crops because both surface water and ground water irrigation sources exist. A network of canals drawing from the upper Yamuna Canal and the Panchana Dam irrigate this area. Depth to groundwater table varies from 5 to 15 m, and therefore well-water irrigation is also practiced. The region produces bajra, sorghum, maize, sugarcane, sesamum and a variety of pulses in the Kharif

season. Wheat, barley, gram and mustard are the dominant crops during Rabi season.

4.9 Sub-humid Southern Plains and the Aravalli Hills (IVa)

This region comprises the Districts of Bhilwara, Chittaurgarh and Rajsamand, and part of Sirohi District (Abu Road and Pindwara Blocks), Udaipur District (Bargain, Bhinder, Girwa, Gogunda, Kherwara, Kotra, Jhadol, Mavli and Sarada Blocks) and Pratapgarh District (Choti Sadri and Pratapgarh blocks). This is a region of low Aravalli hills with the inter-mountain plateau, deeply dissected by streams and rivers. The region has a moderately warm climate in summers and with mild winters. The annual rainfall varies from 311 to 1,470 mm. The highest precipitation in the state is recorded in Abu hills (Sirohi District). There are a number of surface water streams, like Gambhir, Sabarmati, Banas and its tributaries, but they are all ephemeral. The surface rocks are granitic and highly metamorphosed, and so the depressions on the surface are filled with rain water in the form of natural reservoirs.

The area is rich in natural vegetation, which grows on the slopes of the Aravalli and in the wetland areas, but excessive felling of trees has degraded these open forests. Tank water irrigation is most common. The area produces maize as the chief food crop of the Kharif season but in irrigated areas, rice is also grown. In the Rabi season, wheat, gram and oil seeds are the main crops. In areas of black soil, cotton and opium are also cultivated.

4.10 Humid Southern Plains (IVb)

The Districts of Dungarpur, Banswara and part of Udaipur District (Salumber block) and Pratapgarh District (Dhariyawad, Peepalkhunt, and Arnod blocks) are included in this region. The area comprises low Aravalli hills with intrusions of black lava rocks. This is mostly a tribal area where Bhils, Garasiyas and Damors live amidst forests and hills. The area has a humid climate with an average annual rainfall of more than 700 mm. The temperature regimes do not fluctuate much in summer and winter so the area has mild winters and mild summers. The humidity is always high and all these factors combined together promote a profuse growth of natural vegetation. The mountain slopes have an abundance of natural forests.

There are a number of surface water streams. Mahi and its tributaries like Anas, Arau and Jakham have made this area very fertile. The commissioning of Mahi Bajaj Sagar multipurpose project has provided this area with canal irrigation water and electricity. Cotton and sugarcane are the chief cash crops grown in the black soil region. Maize, sorghum and rice are the chief food crops of the Kharif season. Groundnut, mustard, sesamum and rapeseed are also grown. During the Rabi season, wheat, mustard and gram are the main crops.

4.11 Humid South-Eastern Plains (V)

Popularly known as the Hadauti plateau, this region includes the Districts of Baran, Bundi, Jhalawar and Kota, and Part of Sawai Madhopur District (Khandar, Sawai Madhopur blocks). The black soil region of this plateau is fertile and is used for cultivation of sugarcane, cotton and opium. The region has low hills of the Gwalior series, interspersed with broad plateaus of Vindhyan rocks. A large number of rivers drain this area. Chambal is the main river, along with its main tributaries Parwati, Kali Sindh, Parwan and Banas. The development of canal irrigation systems with a series of dams and barrages on the Chambal has made this area rich in agricultural production. Gandhi Sagar, Rana Pratap Sagar and Jawahar Sagar dams, together with Kota Barrage, generate enough electricity and canal water for irrigation.

The region has warm summers but mild winters. Summer temperatures sometimes touch 45°C. The relative humidity is generally high in this zone. The annual rainfall varies from 452 to 985 mm.

Natural vegetation exists in the form of woodlands, parklands and open forests, which have, however, now degraded. Paddy rice and sorghum are the chief food crops grown in the Kharif season. This area is also suitable for soyabean cropping. Wheat, barley, gram and mustard are grown in winter.

5. River Basins of Rajasthan

5.1 Introduction

In current study basin, sub-basin and micro-watershed boundaries have been delineated for the entire State using SRTM DEM (Shuttle Radar Topographic Mission, 90 m resolution data). Historically watersheds were delineated manually. This process is labour intensive, slow, tedious, inconsistent and error-prone. DEM-based techniques can efficiently form the basis of a geographic information system designed to address watershed based analysis. Applications to benefit from these techniques include evaporation modelling, tracing drainage paths and hydrologic simulation modelling.

As described above, the physiography of Rajasthan is basically accentuated by the Aravalli range which forms its water divide backbone, giving rise to originating a number of rivers. In addition, there are rivers that originate outside the State that Rajasthan shares as they flow through it.

Accordingly, 15 defined river basins and remaining area of Rajasthan has been defined as Outside Basin (designated as basin No.16) have been delineated, which differ in their sizes and potentialities. The river basins of Rajasthan, listed in Table 5.1 and shown in Figure 5.1 are further described in following paragraphs.

Table 5.1: Basins and Sub-basins of Rajasthan State

S. No.	River Basin	Number of Sub-basins	Number of Micro-watersheds	Remarks
1	Shekhawati	3	25	Originates from Sikar, Jaipur and Ajmer district in Rajasthan, partly drains to northeast (Haryana State), partly southwest to Sambhar Lake
2	Ruparail	1	14	Originates from Alwar district in Rajasthan, drains towards Yamuna River
3	Banganga	1	32	Originates from Jaipur district in Rajasthan, drains towards Yamuna River
4	Gambhir	1	16	Originates from Karauli district in Rajasthan, drains to Yamuna River
5	Parbati	1	20	Originates from Karauli district in Rajasthan, drains to Gambhir River
6	Sabi	1	20	Originates from Sikar and Jaipur district in Rajasthan, drains to northeast (Haryana State)
7	Banas	10	71	Originates from Rajsamand district in Rajasthan, drains to Chambal River
8	Chambal	7	67	Originates in Madhya Pradesh, flows through south-east Rajasthan and drains to Yamuna River
9	Mahi	6	59	Flows through southern part of Rajasthan, but originates in Madhya Pradesh and continues to adjacent state (Gujarat)
10	Sabarmati	4	15	Originates from Udaipur district in Rajasthan, drains to southwest (Gujarat State)
11	Luni	12	94	Originates from Nagaur district in Rajasthan, drains to Rann of Kuchh (Gujarat State)

S. No.	River Basin	Number of Sub-basins	Number of Micro-watersheds	Remarks
12	West Banas	1	14	Originates from Sirohi district in Rajasthan, drains to southwest (Gujarat State)
13	Sukli	1	11	Originates from Sirohi district in Rajasthan, drains to southwest (Gujarat State)
14	Other Nallahs of Jalore	1	9	Several streams originating from Jalore and Sirohi district in Rajasthan, some draining to southwest (Gujarat State)
15	Ghaggar	1	2	Originates in Himachal Pradesh, flows through Haryana and Punjab and enters north Rajasthan in Hanumangarh district and drains through Ganganagar district to Pakistan
16	Outside Basin	7	72	Western Rajasthan Thar Desert (not actually a river basin)
Total		**58**	**541**	

Figure 5.1: Rajasthan River Basins

5.2 Shekhawati Basin

Shekhawati Basin is located in the north eastern part of the State, occupying an area of 9,750.88 km^2 in Rajasthan.

This basin is drained by a number of Rivers and their smaller-order tributaries, such as the Kantli, Dohan and Krishnawati Rivers. The basin drains in two directions: (1) drainage originating from the dome-shaped hump, constituting the water divide between the north and north-east flowing Kantli, Dohan and Krishnawati Rivers, and (2) the south-flowing Mendha River and its tributaries draining to Sambhar Lake.

There are 3 Sub-basins in Shekhawati Basin namely Dohan, Kantli and Mendha, draining areas of 1,848.08 km^2, 1,878.25 km^2 and 6,024.55 km^2, respectively within Rajasthan. While Dohan has some portion of modelled area outside Rajasthan, Kantli and Mendha Sub-basins are entirely within Rajasthan. More details are given in Volume 2a and Volume 3a of Final Report No. 4.2.

Kantli River originates in the hills south and south-west of Guhala (27°44'00":75°32'00"), flows north and finally disappears in the sand dunes near Naurangpura village (28°22'30":75°27'30") after flowing for a distance of about 134 kms.

In the north-eastern part of the basin, Dohan River descends near Mandoli (27°46'30":75°48'00") from the western slopes of the Dohan Protected Forest (PF) hills and flows towards north-east. The Krishnawati River, another independent River, flows north-east for about 42 kms in Rajasthan and subsequently disappears in Haryana. The drainage pattern is essentially dendritic.

Mendha Sub-basin has a number of lakes, some of which may only be modified (albeit large) ponds. The most prominent of these is Sambhar Lake, occupying an area of about 233 km^2 and having a depth of about 1.2 m at the deepest point. It serves as a confluence for the centripetal drainage originating from the surrounding areas. During the post monsoon period, the lake level recedes due to evaporation during the summer season. Continued evaporation in the geological past has increased the salinity of the lake water.

Two small lakes exist in Nagaur District, south of Kuchaman (27°08'45":74°50'45"). All the lakes in the basin receiving centripetal drainage contain saline water due to prolonged evaporation.

There are 25 micro-watersheds delineated in Shekhawati Basin within Rajasthan boundary.

Table 5.2: Area Details of Shekhawati Basin

Basin	Sub-basin	Micro-watershed Code	Area, km^2
Shekhawati	Dohan	001	185.03
		002	365.79
		003	223.66
		004	315.87

Basin	Sub-basin	Micro-watershed Code	Area, km²
		005	422.62
		006	167.24
		007	167.86
		Sub-Total	**1848.08**
	Kantli	008	190.87
		009	306.70
		010	764.82
		011	130.69
		012	485.17
		Sub-Total	**1878.25**
	Mendha	013	130.04
		014	340.82
		015	234.78
		016	824.05
		017	824.63
		018	1005.80
		019	149.84
		020	407.50
		021	274.91
		022	309.71
		023	469.14
		024	752.32
		025	300.99
		Sub-Total	**6024.55**
Total			**9750.88**

Shekhawati Basin falls in seven Districts of Rajasthan namely: Ajmer (10.15%) Alwar (5.53%), Churu (0.11%), Jaipur (20.48%), Jhunjhunu (18.19%), Nagaur (14.97%) and Sikar (30.57%). Maximum area of Shekhawati Basin is covered by Sikar District followed by Jaipur District.

Weather statistics for Shekhawati Basin have been analysed and presented in Table 5.3 based on the 20 years (1990-2009) monthly IMD weather data except for rainfall analysis which is based on IMD, RD and WRD data of 54 years (1957-2010). The statistical values presented in Table 5.3 are the values which varies spatially over the region i.e. they signify the spatial variation of a weather parameter over the basin.

Table 5.3: Weather Parameter Statistics for Shekhawati Basin

Weather Parameter	Minimum	Maximum	Mean	Standard Deviation	Coefficient of Variation
Mean Maximum Temperature, °C	32.60	33.19	32.95	0.11	0.00
Highest Maximum Temperature, °C	43.72	46.04	45.38	0.53	0.01
Mean Minimum Temperature, °C	17.30	20.69	19.02	0.72	0.04
Lowest Minimum Temperature, °C	0.20	5.98	2.83	1.32	0.47
Annual Rainfall, mm	329.40	643.00	489.60	61.20	0.13
Monsoon Months Rainfall, mm	305.90	568.90	434.60	50.60	0.12
Rainy Days, Days/yr	15.00	31.00	26.00	2.90	0.11
Wind Speed, km/hr	3.60	6.77	5.05	0.64	0.13

Weather Parameter	Minimum	Maximum	Mean	Standard Deviation	Coefficient of Variation
Sunshine Hours, hr/day	7.91	8.13	7.96	0.04	0.01
Relative Humidity, %	43.55	55.60	49.36	2.47	0.05
Annual Evaporation, cm	204.62	225.52	216.68	4.26	0.02

Source: IMD monthly dataset (1990-2009); Rainfall statistics based on IMD, RD and WRD dataset (1957-2010)

Mean Annual Rainfall in Shekhawati Basin is 489.60 mm. Highest maximum temperature ranges from 43.72-46.04°C with a mean value of 45.38°C, while Lowest minimum temperature ranges from 0.20-5.98°C with a mean value of 2.83°C.

Shekhawati Basin has 1 Medium and 79 Minor existing projects with cumulative live storage capacity of 8.32 Mm^3 and 70.89 Mm^3, respectively. The approximate water storage capacity of 2,428 WHSs in basin is 113.47 Mm^3. The salient features of existing projects are given in Appendix 4.

5.3 Ruparail Basin

Ruparail Basin is located in the north-eastern part of the State and covers an area of about 4,034 km^2 in Rajasthan, mainly in Alwar and Bharatpur Districts.

Ruparail River, also known as Barah, descends in the Udainath hills of Thanagazi Reserved Forest (RF) in Alwar District. In the upper reaches, it traverses through the hills and then through plains, nearly up to Kusalpur (27°25':76°32"). The river has a total length of about 104 kms.

The basin contains several drainage systems that may be generally grouped in the following major systems:

- A Northern Group that comprises an eastern sub-system which starts in a southerly direction along the upper eastern valley and a western sub-system that descends in a northern group of Udainath hills and flows in a south-easterly direction. Both sub-systems veer in a nearly U-turn to move in a north-eastern direction ultimately entering the Haryana State.
- A southern fan of drains descending in a southern part of Udainath hills, which form the Ruparail River, that flows generally in an easterly direction and eventually disappearing in the Alluvial plains up to the State's boundary with Uttar Pradesh.

A number of smaller order tributaries, namely, the Narainpur, Golari, Sukri, Shanganga and Nalakroti, also originate from the Udainath hills of Alwar District. More details are given in Volume 2a and Volume 3a of Final Report No. 4.2.

There are 14 micro-watersheds delineated in Ruparail Basin within Rajasthan boundary.

Table 5.4: Area Details of Ruparail Basin

Basin	Sub-basin	Micro-watershed Code	Area, km²
Ruparail	Ruparail	001	473.39
		002	366.61
		003	465.88
		004	180.12
		005	162.57
		006	365.15
		007	289.04
		008	261.38
		009	335.91
		010	66.46
		011	144.13
		012	440.49
		013	188.16
		014	294.37
Total			**4,033.66**

Ruparail Basin falls in two Districts of Rajasthan namely: Alwar (67.07%) and Bharatpur (32.93%).

Weather statistics for Ruparail Basin have been analysed and presented in Table 5.5 based on the 20 years (1990-2009) monthly IMD weather data except for rainfall analysis which is based on IMD, RD and WRD data of 54 years (1957-2010). The statistical values presented in Table 5.5 are the values which varies spatially over the region i.e. they signify the spatial variation of a weather parameter over the basin.

Table 5.5: Weather Parameter Statistics for Ruparail Basin

Weather Parameter	Minimum	Maximum	Mean	Standard Deviation	Coefficient of Variation
Mean Maximum Temperature, °C	32.90	33.35	33.10	0.09	0.00
Highest Maximum Temperature, °C	45.59	46.31	45.94	0.15	0.00
Mean Minimum Temperature, °C	18.79	19.21	19.02	0.09	0.00
Lowest Minimum Temperature, °C	2.51	3.43	3.02	0.20	0.07
Annual Rainfall, mm	502.80	718.50	626.10	31.50	0.05
Monsoon Months Rainfall, mm	444.40	637.00	555.00	28.00	0.05
Rainy Days, Days/Year	28.00	36.00	32.00	1.60	0.05
Wind Speed, Km/hr	4.62	5.47	4.84	0.19	0.04
Sunshine Hours, hr/day	7.93	7.97	7.95	0.01	0.00
Relative Humidity, %	50.08	52.87	51.50	0.60	0.01
Annual Evaporation, cm	214.01	220.31	216.14	1.53	0.01

Source: IMD monthly dataset (1990-2009) ; Rainfall statistics based on IMD,RD and WRD dataset (1957-2010)

Mean Annual Rainfall in Ruparail Basin is 626.10 mm. Highest maximum temperature ranges from 45.59-46.31°C with a mean value of 45.94°C while Lowest minimum temperature ranges from 2.51-3.43°C with a mean value of 3.02°C.

Ruparail Basin has 1 Major (diversion), 1 Medium and 64 Minor existing projects with cumulative live storage capacity of 36.60 Mm^3, 24.92 Mm^3 and 72.25 Mm^3, respectively. The approximate water storage capacity of 1,559 WHSs in basin is 56.14 Mm^3. The salient features of existing projects are given in Appendix 4. In addition to this, Ruparail basin gets imported surface water (Yamuna River share) through Gurgaon Canal, details of which are given in Chapter 12.

5.4 Banganga Basin

Banganga River originates in the Aravali hills, near Arnasar and Bairath in Jaipur District, and lies between latitudes 26°40' and 27°37' and longitudes 75°49' and 77°39' having a catchment area of 8,583 km^2 in Rajasthan. It flows towards the south up to the village of Ghat, then towards east through partly hilly and partly plain terrain. The total length of the river is 240 kms. The main tributaries are Gumti Nalla and Suri River, joining it on its right bank, and Sanwan and Palasan Rivers, on its left bank.

A hilly terrain extends on both sides of the river in the upstream portion of the basin. Weathered basement outcrops are found between the hilly terrain and the Alluvial areas. Alluvial terrain, mainly in the lower part of the basin includes features like meandering scars and abandoned channel courses. The geological sequence consists of Limestone, Quartzites, Phyllites & Schist, Alluvial and windblown Sands, Silt, Clay, etc. A major portion of the basin is covered by Alluvial deposits with isolated and scattered hillocks. More details are given in Volume 2a and Volume 3a of Final Report No. 4.2.

There are 32 micro-watersheds delineated in Banganga Basin within Rajasthan boundary.

Table 5.6: Area Details of Banganga Basin

Basin	Sub-basin	Micro-watershed Code	Area, km^2
Banganga	Banganga	001	279.87
		002	209.68
		003	420.86
		004	121.44
		005	334.78
		006	148.57
		007	145.17
		008	314.87
		009	243.79
		010	441.18
		011	254.17
		012	88.49
		013	383.79
		014	270.80

Basin	Sub-basin	Micro-watershed Code	Area, km²
		015	148.67
		016	319.28
		017	319.85
		018	193.65
		019	251.36
		020	243.33
		021	205.28
		022	259.05
		023	235.78
		024	134.57
		025	482.66
		026	205.15
		027	104.32
		028	194.13
		029	376.83
		030	632.28
		031	229.49
		032	390.21
Total			**8,583.34**

Banganga Basin falls in seven Districts of Rajasthan namely: Alwar (27.20%), Bharatpur (29.48%), Dausa (24.99%), Jaipur (15.41%), Karauli (2.85%), Sawai Madhopur (0.06%) and Sikar (0.01%). Maximum area of Banganga Basin is covered by Bharatpur District followed by Alwar District.

Weather statistics for Banganga Basin have been analysed based on the 20 years (1990-2009) monthly IMD weather data except for rainfall analysis which is based on IMD, RD and WRD data of 54 years (1957-2010), which is presented in Table 5.7. The statistical values presented in Table 5.7 are the values which varies spatially over the region i.e. they signify the spatial variation of a weather parameter over the basin.

Table 5.7: Weather Parameters Statistics of Banganga Basin

Weather Parameter	Minimum	Maximum	Mean	Standard Deviation	Coefficient of Variation
Mean Maximum Temperature, °C	32.55	33.62	33.08	0.25	0.01
Highest Maximum Temperature, °C	45.16	46.69	45.87	0.37	0.01
Mean Minimum Temperature, °C	19.03	19.32	19.23	0.05	0.00
Lowest Minimum Temperature, °C	2.93	3.76	3.46	0.15	0.04
Annual Rainfall, mm	576.60	730.30	640.60	20.30	0.03
Monsoon Months Rainfall, mm	516.20	649.80	576.60	18.50	0.03
Rainy Days, Days/yr	30.00	35.00	32.00	1.10	0.03
Wind Speed, km/hr	4.51	6.96	5.17	0.59	0.11
Sunshine Hours, hr/day	7.91	7.98	7.94	0.02	0.00
Relative Humidity, %	48.63	54.34	51.17	1.37	0.03
Annual Evaporation	214.26	226.36	218.84	3.17	0.01

Source: IMD monthly dataset (1990-2009); Rainfall Statistics based on IMD, RD and WRD dataset (1957-2010)

Mean Annual Rainfall in Banganga Basin is 640.60 mm. Highest maximum temperature ranges from 45.16-46.69°C with a mean value of 45.87°C, while Lowest minimum temperature ranges from 2.93-3.76°C with a mean value of 3.46°C.

Banganga basin has 1 Major, 5 Medium and 196 Minor existing projects with cumulative live storage capacity of 73.58 Mm^3, 73.28 Mm^3 and 233.61 Mm^3, respectively. The approximate water storage capacity of 4,039 WHSs in basin is 128.76 Mm^3. The salient features of existing projects are given in Appendix 4. In addition to this, Banganga basin gets imported surface water (Yamuna River share) through Gurgaon Canal and Bharatpur Feeder, details of which are given in Chapter 12.

5.5 Gambhir Basin

Gambhir River originates in the hills near Karauli town in Karauli District and follows a northerly course up to Lapavati, where it takes an easterly turn. Near the village Pali it enters Bharatpur District. Gambhir River is ephemeral. Gambhir Basin is located in the eastern part of Rajasthan State and covers an area of 4,693.52 km^2 within Rajasthan. It is surrounded in the north by Banganga Basin, in south by Parbati Basin and in the west by Banas Basin. More details are given in Volume 2a and Volume 3a of Final Report No. 4.2.

There are 16 micro-watersheds delineated in Gambhir Basin within Rajasthan boundary.

Table 5.8: Area Details of Gambhir Basin

Basin	Sub-basin	Micro-watershed Code	Area, km^2
Gambhir	Gambhir	001	383.75
		002	812.46
		003	245.23
		004	317.59
		005	164.58
		006	221.85
		007	378.61
		008	395.07
		009	238.31
		010	265.94
		011	243.72
		012	186.36
		013	221.82
		014	233.70
		015	164.28
		016	220.25
Total			**4,693.52**

Gambhir Basin falls in five Districts of Rajasthan namely: Bharatpur (25.95%), Dausa (2.17%), Dhaulpur (15.40%), Karauli (51.61%) and Sawai Madhopur (4.87%). Maximum area of Gambhir Basin is covered by Karauli District followed by Bharatpur District.

Weather statistics for Gambhir Basin have been analysed based on the 20 years (1990-2009) monthly IMD weather data except for rainfall analysis which is based on IMD, RD and WRD data of 54 years (1957-2010), which is presented in Table 5.9. The statistical values presented in Table 5.9 are the values which varies spatially over the region i.e. they signify the spatial variation of a weather parameter over the basin.

Table 5.9: Weather Parameter Statistics for Gambhir Basin

Weather Parameter	Minimum	Maximum	Mean	Standard Deviation	Coefficient of Variation
Mean Maximum Temperature, °C	32.96	33.89	33.38	0.24	0.01
Highest Maximum Temperature, °C	45.73	47.08	46.35	0.35	0.01
Mean Minimum Temperature, °C	19.26	19.34	19.29	0.01	0.00
Lowest Minimum Temperature, °C	3.62	4.05	3.74	0.08	0.02
Annual Rainfall, mm	566.60	735.80	643.60	25.70	0.04
Monsoon Months Rainfall, mm	518.30	668.50	585.40	23.20	0.04
Rainy Days, Days/yr	29.00	34.00	32.00	1.00	0.00
Wind Speed, km/hr	3.53	4.89	4.33	0.25	0.06
Sunshine Hours, hr/day	7.93	8.01	7.97	0.02	0.00
Relative Humidity, %	50.72	55.84	53.12	1.27	0.02
Annual Evaporation, cm	213.14	220.45	215.86	1.48	0.01

Source: IMD monthly dataset (1990-2009); Rainfall statistics based on IMD,RD and WRD dataset (1957-2010)

Mean Annual Rainfall in Gambhir Basin is 643.60 mm. Highest maximum temperature ranges from 45.73-47.08°C with a mean value of 46.35°C, while Lowest minimum temperature ranges from 3.62-4.05°C with a mean value of 3.74°C.

Gambhir Basin has 3 Medium and 113 Minor existing projects with cumulative live storage capacity of 134.80 Mm^3 and 102.93 Mm^3, respectively. The approximate water storage capacity of 1,913 WHSs in basin is 81.21 Mm^3. The salient features of existing projects are given in Appendix 4.

5.6 Parbati Basin

Parbati River originates in the hills near Rampur-Langra ranges of Karauli District. It flows in a southwest-northeast direction and joins River Parbati near Kharaghar village in the Dhaulpur District. It lies between 26°22' and 26°55' North latitude and 77°09' and 78°16' East longitude.

Parbati Basin is located on the eastern edge of the Rajasthan State. It occupies an area of 1,887.07 km^2 and covers major part of Dhaulpur District and parts of Karauli and Bharatpur Districts. It lies between Gambhir Basin in the north and Chambal basin in the south. The eastern periphery of the basin forms the State boundary with State of Uttar Pradesh. More details are given in Volume 2a and Volume 3a of Final Report No. 4.2.

There are 20 micro-watersheds delineated in Parbati Basin within Rajasthan boundary.

Table 5.10: Area Details of Parbati Basin

Basin	Sub-basin	Micro-watershed Code	Area, km²
Parbati	Parbati	001	29.96
		002	135.54
		003	48.33
		004	159.48
		005	135.85
		006	55.87
		007	86.41
		008	59.18
		009	129.33
		010	89.99
		011	17.96
		012	81.36
		013	135.38
		014	34.06
		015	98.16
		016	106.85
		017	108.95
		018	145.12
		019	84.56
		020	44.75
Total			**1,887.07**

Parbati Basin falls in three Districts of Rajasthan namely: Bharatpur (0.38%), Dhaulpur (78.94%) and Karauli (20.68%).

Weather statistics for Parbati Basin have been analysed based on 20 years (1990-2009) monthly IMD weather data except for rainfall analysis which is based on IMD, RD and WRD data of 54 years (1957-2010) and are presented in Table 5.11. The statistical values presented in Table 5.11 are the values which varies spatially over the region i.e. they signify the spatial variation of a weather parameter over the basin.

Table 5.11: Weather Parameter Statistics for Parbati Basin

Weather Parameters	Minimum	Maximum	Mean	Standard Deviation	Coefficient of Variation
Mean Maximum Temperature, °C	33.30	33.90	33.69	0.17	0.01
Highest Maximum Temperature, °C	46.26	47.10	46.81	0.25	0.01
Mean Minimum Temperature, °C	19.29	19.34	19.30	0.01	0.00
Lowest Minimum Temperature, °C	3.70	3.96	3.74	0.05	0.01
Annual Rainfall, mm	567.10	736.40	648.40	28.20	0.04
Monsoon Months Rainfall, mm	518.70	669.80	592.70	591.20	0.04
Rainy Days, Days/yr	27.80	33.80	31.10	1.30	0.04
Wind Speed, km/hr	3.83	4.45	4.23	0.12	0.03
Sunshine Hours, hr/day	7.97	8.00	7.99	0.01	0.00
Relative Humidity, %	52.86	55.90	54.81	0.90	0.02
Annual Evaporation, cm	213.46	215.15	214.21	0.42	0.00

Source: IMD monthly dataset (1990-2009); Rainfall Statistics based on IMD, RD and WRD dataset (1957-2010)

Mean Annual Rainfall in Parbati Basin is 648.40 mm. Highest maximum temperature ranges from 4546.26-47.10°C with a mean value of 46.81°C, while Lowest minimum temperature ranges from 3.70-3.96°C with a mean value of 3.74°C.

Parbati Basin has 1 Major, 2 Medium and 21 Minor existing projects with cumulative live storage capacity of 108.29 Mm^3, 44.53 Mm^3 and 17.64 Mm^3, respectively. The approximate water storage capacity of 727 WHSs in basin is 13.46 Mm^3. The salient features of existing projects are given in Appendix 4.

5.7 Sabi Basin

Sabi River originates from the eastern slopes of the Saiwar Protected Forest hills in Sikar District of Rajasthan State. After covering about 157 km distance in the State, it enters Haryana beyond Kotkasim, near village Ujauli and covers a total distance of about 222 km up to Dhasa Bund. In some of its reaches, from Mandawar and Kotkasim to Haryana border, meandering of the river causes bank erosion. Otherwise, the river has a defined course up to Pataudi railway station and thereafter the water spreads, flowing into several branches, till its outfall into the link drain from Jahajgarh Jheel to Najafgarh Jheel. The flow ultimately joins Yamuna River through the Najafgarh Drain.

The catchment area of Sabi River in Rajasthan is 4,523.67 km^2 which covers parts of Jaipur, Alwar and Sikar Districts, between latitudes 27°16' and 28°11' and longitudes 75°42' and 76°57' (See Table 1.1-1). The main tributaries of Sabi are Sota, Kotkasim Drain and Indori Nallah. More details are given in Volume 2a and Volume 3b of Final Report No. 4.2.

There are 20 micro-watersheds delineated in Sabi Basin within Rajasthan boundary.

Table 5.12: Area Details of Sabi Basin

Basin	Sub-basin	Micro-watershed Code	Area, km^2
Sabi	Sabi	001	104.48
		002	174.33
		003	96.58
		004	59.31
		005	107.94
		006	172.08
		007	214.29
		008	254.73
		009	103.69
		010	198.71
		011	287.05
		012	289.86
		013	220.28
		014	287.58
		015	425.48
		016	368.36
		017	135.03
		018	155.46

Basin	Sub-basin	Micro-watershed Code	Area, km²
		019	569.74
		020	298.69
Total			4,523.67

Sabi Basin falls in three Districts of Rajasthan namely: Alwar (62.11%), Jaipur (29.30%) and Sikar (8.59%).

Weather statistics for Sabi Basin have been analysed based on the 20 years (1990-2009) monthly IMD weather data except for rainfall analysis which is based on IMD, RD and WRD data of 54 years (1957-2010), and is presented in Table 5.13. The statistical values presented in Table 5.13 are the values which varies spatially over the region i.e. they signify the spatial variation of a weather parameter over the basin.

Table 5.13: Weather Parameter Statistics for Sabi Basin

Weather Parameter	Minimum	Maximum	Mean	Standard Deviation	Coefficient of Variation
Mean Maximum Temperature, °C	32.81	33.12	33.00	0.06	0.00
Highest Maximum Temperature, °C	45.45	45.99	45.80	0.13	0.00
Mean Minimum Temperature, °C	18.34	19.13	18.77	0.15	0.01
Lowest Minimum Temperature, °C	1.64	3.14	2.45	0.29	0.12
Annual Rainfall, mm	494.90	722.90	627.60	28.90	0.05
Monsoon Months Rainfall, mm	441.60	640.80	553.80	25.60	0.05
Rainy Days, Days/yr	25.00	36.00	30.00	1.50	0.05
Wind Speed, km/hr	4.36	5.87	4.86	0.33	0.07
Sunshine Hours, hr/day	7.92	7.96	7.94	0.01	0.00
Relative Humidity, %	49.51	52.15	51.17	0.68	0.01
Annual Evaporation	212.17	221.97	215.91	2.27	0.01

Source: IMD monthly dataset (1990-2009); Rainfall Statistics based on IMD, RD and WRD dataset (1957-2010)

Mean Annual Rainfall in Sabi Basin is 627.60 mm. Highest maximum temperature ranges from 45.45-45.99°C with a mean value of 45.8°C, while Lowest minimum temperature ranges from 1.64-3.14°C with a mean value of 2.45°C.

Sabi Basin has 2 Medium and 70 Minor existing projects with cumulative live storage capacity of 38.59 Mm^3 and 87.92 Mm^3, respectively. The approximate water storage capacity of 1,436 WHSs in basin is 36.10 Mm^3. The salient features of existing projects are given in Appendix 4. There is 1 ongoing project in Sabi basin, salient features of which are given in Appendix 5.

5.8 Banas Basin

Banas River originates in the Khamnor hills of the Aravali range (about 5 km from Kumbhalgarh) and flows generally in a southwest-northeast direction. Entire length of the river is about 512 km, which lies in Rajasthan State. It is a major tributary of the River Chambal, to which it meets near village Rameshwar in the Khandar Block in Sawai Madhopur District.

Banas Basin having catchment area of 47,060 Km^2 within Rajasthan lies between latitudes 24°15' and 27°20' and longitudes 73°25' and 77°00'. The main tributaries of Banas are Berach and Menali on the right, and Kothari, Khari, Dai, Dheel, Sohadara, Morel and Kalisil on the left.

Western and northern boundaries of the Banas Basin are formed by the Aravali hill ranges, having a maximum elevation of about 1,200 m amsl. East of the Aravali range, the area is characterised by generally flat to undulating topography, with small isolated ridges and hills. The broad Banas Alluvial plain, deposited in the form of small, isolated valley fills, slopes generally northwards. The width of the Alluvial plain increases towards downstream. The Alluvial deposits of the Banas River thin out towards the west, while the thickness increases towards east and north. Extensive dunes cover the Basin areas in Jaipur, Ajmer and Dausa Districts. The geological sequence consists of basaltic lava flows, Sandstone, Limestone, shale, schists, gneiss, silt, clay and sand.

There are 10 Sub-basins in Banas namely Banas (11,726.43 Km^2), Berach (8,307.89 Km^2), Dain (3,061.38 Km^2), Gudia (920.39 Km^2), Kalisil (623.09 Km^2), Khari (6,390.53 Km^2), Kothari (2,298.51 Km^2), Mashi (6,472.12 Km^2), Morel (5,740.50 Km^2), Sodra (1,519.43 Km^2). More details are given in Volume 2b and Volume 3b of Final Report No. 4.2.

Brief descriptions of the important tributaries are given in the following paragraphs.

Berach River

Berach River originates from the hills northeast of Udaipur City. It flows in a northeast direction for about 157 km in Udaipur, Chittaurgarh and Bhilwara Districts before joining the Banas near Bigod village in Mandalgarh Tehsil of Bhilwara District. The river flows in a hilly region up to Badgaon reservoir and then through plains. Its catchment lies between latitudes 24°29' and 25°14' and longitudes 73°25' and 75°02'. The main tributaries of Berach are Ayar, Wagli Wagon, Gambhiri and Orai joining from the right.

Kothari River

Kothari River originates from the eastern slopes of the Aravali range near Horera village in Bhilwara District. The river flows through Rajsamand and Bhilwara Districts for about 51 km in a hilly region, and further 100 km through plains, before joining the Banas near Nandrai village in Bhilwara District. The catchment lies between latitudes 25°14'30" and 25°34'45" and longitudes 73°47'30" and 75°3'30". Bahamani River is the only major tributary joining Kothari River from the right near Choppan village in Bhilwara District.

Khari River

Khari River originates from the hills near Deogarh in Rajsamand District. It flows northeast for about 192 km through Udaipur, Bhilwara and Ajmer Districts before joining the Banas River near Chosala village in Ajmer District. The catchment lies between latitudes 25°26' and 25°05' and longitudes 73°50' and 75°21'. The main tributaries of Khari River are Nekhadi and Bara Rivers on the left and Mansi River on the right.

Dai River

Dai River originates in the south-eastern slopes of the Aravali range, near Nasirabad Tehsil of Ajmer District. It flows southeast for about 40 km and east for about 56 km in Ajmer District and for a short reach through Tonk District, before joining Banas River near Bisalpur village in Tonk District. The catchment lies between latitudes 25°5' and 26°31' and longitudes 74°29' and 75°29'. A large number of nallahs join Dai River in Ajmer and Tonk Districts.

Mashi River

Mashi River originates from the hills near Kishangarh in Ajmer District. It flows initially in an eastward direction and then towards south for about 96 km in partly hilly and partly plain areas of Ajmer and Tonk Districts before joining Banas River near Tonk. The catchment is located between latitudes 26°11' and 26°16' and longitudes 74°48' and 75°54'. The main tributaries of the river are the streams Bandi, near Dudu, and Sohadara.

Sohadara River

Sohadara River originates in the hills east of Ajmer. It flows eastwards for about 100 km in Tonk District before joining Mashi River near Dhundia village. The catchment lies between latitudes 26°06' and 26°26' and longitudes 75°00' and 75°44'. A number of nallahs join the river.

Morel River

Morel River originates in the hills near Dharla and Chainpura villages in Bassi Tehsil of Jaipur District. It flows in a southeast direction for 29 km, then towards southwest for 35 km, up to the confluence with river Dhund. It flows further southeast for 83 km in Jaipur and Sawai Madhopur Districts, before joining Banas River near Hadoli village in Karauli Tehsil of Sawai Madhopur District. The catchment lies between latitudes 26°14' and 27°9' and longitudes 75°42' and 76°56'. The main tributaries of Morel are Dhund, Kankrauli and Kalisil Rivers. Description of a separate Sub-basin for Kalisil River is given below.

Kalisil River

Kalisil River originates from the hills near Rajpura village in Sawai Madhopur District. The river flows generally towards southwest, partly through hills and partly in the plains of Sawai Madhopur District, for about 48 km, before joining Morel River. The catchment lies between latitudes 26°8' and 26°25' and longitudes 76°37' and 76°56'. A few small nallahs join the river.

Dheel River

Dheel River originates from the plains near Bauli village in Tonk District. The river flows generally from north to south in Jaipur, Tonk and Sawai Madhopur Districts, for about 64 km, before joining Banas River near Philpura village in Sawai Madhopur District. The catchment lies between latitudes 26°11' and 26° 32' and longitudes 75°48' and 76°14'. Gudia River is the main tributary of river Dheel.

There are 71 micro-watersheds delineated in Banas Basin within Rajasthan boundary.

Table 5.14: Area Details of Banas Basin

Basin	Sub-basin	Micro-watershed Code	Area, km²
Banas	Banas	001	1,388.23
		002	719.28
		003	902.15
		004	2,017.01
		005	154.02
		006	1,438.62
		007	560.40
		008	644.25
		009	682.34
		010	867.94
		011	659.72
		012	601.83
		013	405.06
		014	253.31
		015	285.38
		016	146.89
		Sub-Total	**11,726.43**
	Berach	017	646.42
		018	1,790.23
		019	26.09
		020	67.78
		021	507.80
		022	238.27
		023	818.42
		024	308.02
		025	559.36
		026	251.96
		027	267.21
		028	125.82
		029	540.63
		030	45.65
		031	210.33
		032	121.02
		033	285.14
		034	527.47
		035	354.00
		036	616.27
		Sub-Total	**8,307.89**
	Dain	037	846.21
		038	1,489.37
		039	725.80
		Sub-Total	**3,061.38**
	Gudia	040	762.94
		041	157.45
		Sub-Total	**920.39**
	Kalisil	042	347.90
		043	275.19

Basin	Sub-basin	Micro-watershed Code	Area, km²
		Sub-Total	**623.09**
	Khari	044	53.64
		045	859.76
		046	2,165.05
		047	670.63
		048	415.03
		049	576.76
		050	420.71
		051	616.23
		052	612.72
		Sub-Total	**6,390.53**
	Kothari	053	96.58
		054	1,641.18
		055	560.75
		Sub-Total	**2,298.51**
	Mashi	056	669.90
		057	814.15
		058	1,217.30
		059	2,424.13
		060	600.06
		061	746.58
		Sub-Total	**6,472.12**
	Morel	062	400.99
		063	1,259.11
		064	356.73
		065	1,222.87
		066	134.45
		067	736.51
		068	1,629.84
		Sub-Total	**5,740.50**
	Sodra	069	200.21
		070	479.66
		071	839.56
		Sub-Total	**1,519.43**
Total			**47,060.27**

Banas Basin falls in twelve Districts of Rajasthan namely: Ajmer (11.80%), Bhilwara (19.97%), Bundi (0.36%), Chittaurgarh (11.60%), Dausa (2.51%), Jaipur (13.80%), Karauli (2.37%), Pratapgarh (0.37%), Rajsamand (8.96%), Sawai Madhopur (8.20%), Tonk (14.37%) and Udaipur (5.70%). Maximum area of Banas Basin is covered by Bhilwara District followed by Tonk District.

Weather statistics for Banas Basin have been analysed based on 20 years (1990-2009) monthly IMD weather data except for rainfall analysis which is based on IMD, RD and WRD data of 54 years (1957-2010). The statistical values presented in Table 5.15 are the values which varies spatially over the region i.e. they signify the spatial variation of a weather parameter over the basin.

Table 5.15: Weather Parameter Statistics of Banas Basin

Weather Parameter	Minimum	Maximum	Mean	Standard Deviation	Coefficient of Variation
Mean Maximum Temperature, °C	32.11	33.20	32.77	0.19	0.01
Highest Maximum Temperature, °C	43.19	46.30	44.89	0.66	0.01
Mean Minimum Temperature, °C	17.50	20.66	19.05	0.71	0.04
Lowest Minimum Temperature, °C	1.76	6.05	3.79	0.82	0.22
Annual Rainfall, mm	341.80	868.20	588.80	92.40	0.16
Monsoon Months Rainfall, mm	326.50	810.60	544.50	87.10	0.16
Rainy Days, Days/yr	18.00	37.00	29.00	3.50	0.12
Wind Speed, km/hr	1.40	8.50	4.74	1.29	0.27
Sunshine Hours, hr/day	7.90	8.38	8.11	0.16	0.02
Relative Humidity, %	43.65	55.10	50.54	2.26	0.04
Annual Evaporation, cm	167.76	228.10	210.56	9.83	0.05

Source: IMD monthly dataset (1990-2009) ; Rainfall statistics based on IMD,RD and WRD dataset (1957-2010)

Mean Annual Rainfall in Banas Basin is 588.80 mm. Highest maximum temperature ranges from 43.19-46.3°C with a mean value of 44.89°C, while Lowest minimum temperature ranges from 1.76-6.05°C with a mean value of 3.79°C.

Banas Basin has 9 Major, 33 Medium and 1,302 Minor existing projects with cumulative live storage capacity of 1,426.56 Mm^3, 809.70 Mm^3 and 1,204.74 Mm^3, respectively. The approximate water storage capacity of 31,572 WHSs in basin is 1,541.32 Mm^3 while considering the WHS in Gambhiri and Orai project catchment outside Rajasthan the approximate water storage capacity of 31,610 WHSs is 1,542.53 Mm^3. The salient features of existing projects are given in Appendix 4. There are 3 ongoing and 2 proposed projects in Banas basin, salient features of which are given in Appendix 5.

5.9 Chambal Basin

Chambal River, a principal tributary of Yamuna River, originates in the Vindhyan range near Mhow in Indore District of Madhya Pradesh, at an elevation of 354 m amsl, at latitude 22°27' and longitude 73°20'. The river flows through the States of Madhya Pradesh, Rajasthan and Uttar Pradesh. Chambal Basin has a catchment area of 31,242 km^2 in Rajasthan and lies between longitudes 73°20' and 79°20' and latitudes 22°27' and 27°20'.

The basin is roughly rectangular in shape, its maximum length being 560 kms in a northeast - southwest direction. The river flows for some 320 kms in a generally northerly direction before entering a deep gorge in Rajasthan at Chourasigarh, about 96 kms upstream of Kota. The deep gorge extends up to Kota. The river flows for about 226 kms in Rajasthan in a north-easterly direction, and then forms the boundary between Madhya Pradesh and Rajasthan in a length of about 252 kms. Thereafter, the river forms the boundary between Madhya Pradesh and Uttar Pradesh for about 117 kms, entering UP near Charak Nagar village and flows for about 40 kms before joining Yamuna River.

There are seven Sub-basins in Chambal Basin within Rajasthan, namely: Chakan (747.94 km^2), Chambal Downstream (4,571.56 km^2), Chambal Upstream (4,254.99 km^2), Kalisindh (10,068.86 km^2), Kunu (774.57 km^2), Mej (5,803.76 km^2) and Parwati (5,020.82 km^2). More details are given in Volume 2b and Volume 3b of Final Report No. 4.2.

Main tributaries of Chambal River are Siwana, Retam, Shipra and Choti Kalisindh in MP, Kalisindh, Parwati, Parwan and Banas in Rajasthan.

A brief description of important tributaries in Rajasthan is given in the following paragraphs.

Kalisindh River

River Kalisindh originates in the northern slopes of the Vindhya hills. It flows in MP and enters Rajasthan near Binda village in Jhalawar District. It flows for about 145 km north in Rajasthan before joining river Chambal near Nonera village in Kota District. The catchment in Rajasthan extends over parts of Jhalawar and Kota Districts. Important tributaries of the Kalisindh are Ahu, Amjhar and Parwan. As Parwan has been defined as a separate sub-basin its description is given below.

Parwan River

River Parwan is an important interstate river. It originates in the Malwa Plateau and after flowing for about 186 km in MP enters Rajasthan near Kharibor village in Jhalawar District. It joins river Kalisindh near Ramgarh village in Kota District. The Rajasthan portion of the catchment lies in Jhalawar and Kota Districts. The main tributaries of river Parwan are Ujar, Newaj, Ghar, Chappi and Ghorapachhar.

Mej River

River Mej originates east of Mandalgarh Tehsil in Bhilwara District and joins river Chambal near Bhaius Khana village in Kota District. The catchment extends over Bhilwara, Bundi, and Tonk Districts.

Chakan River

River Chakan is formed by the confluence of many local nallahs. The river flows in a south-easterly direction and joins river Chambal near Karanpura village in Sawai Madhopur District. The catchment is situated in Sawai Madhopur, Tonk, Bundi and Kota Districts.

Parwati River

Parwati river originates in the northern slopes of the Vindhyan hills in MP. It enters Rajasthan near Chatarpura village in Baran District, where it forms the boundary between MP and Rajasthan for about 18 km, then flows for about 83 km in Rajasthan before again forming the boundary between MP and Rajasthan for a length of about 58 km up to Pali village in Kota District, where it joins the Chambal. The river catchment in Rajasthan is situated in Kota and Jhalawar Districts. The important tributaries of the Parwati river are Lhasi, Berni, Bethli, Andheri, Retri, Dubraj, Bilas and Kunu.

Kunu River

River Kunu originates north of Guna town in MP. It flow for 48 km in MP before entering Rajasthan near Museri village in Baran District. The river enters again MP and flows north for about 24 km before again re-entering Rajasthan near Gordhanpura village in Kota District and joins Chambal river. The main tributaries of river Kunu are Karal and Rempi.

Chambal River upstream and downstream of Kota Barrage

The areas draining directly into River Chambal and not included in any of the above sub-basins, has been divided into two Sub-Basins: Chambal Upstream of Kota Barrage and Chambal Downstream of Kota Barrage upto Rajasthan border.

There are 67 micro-watersheds delineated in Chambal Basin within Rajasthan boundary.

Table 5.16: Area Details of Chambal Basin

Basin	Sub-basin	Micro-watershed Code	Area, Km²
Chambal	Chakan	001	68.50
		002	679.40
		Sub-Total	**747.90**
	Chambal Downstream	003	639.80
		004	179.60
		005	779.80
		006	102.50
		007	809.00
		008	422.00
		009	329.10
		010	744.50
		011	565.30
		Sub-Total	**4571.60**
	Chambal Upstream	012	453.80
		013	419.40
		014	207.10
		015	348.70
		016	647.80
		017	489.10
		018	343.50
		019	161.70
		020	288.20
		021	299.40
		022	596.30
		Sub-Total	**4255.00**
	Kalisindh	023	709.00
		024	120.50
		025	229.70
		026	897.90
		027	65.30
		028	589.20
		029	440.30
		030	186.90

Basin	Sub-basin	Micro-watershed Code	Area, Km²
		031	189.80
		032	747.10
		033	1023.50
		034	134.20
		035	508.60
		036	420.60
		037	236.70
		038	351.40
		039	464.40
		040	565.60
		041	690.90
		042	204.70
		043	960.30
		044	332.30
		Sub-Total	**10068.90**
	Kunu	045	774.60
		Sub-Total	**774.60**
	Mej	046	341.10
		047	229.40
		048	1743.70
		049	118.60
		050	313.30
		051	155.30
		052	510.00
		053	1642.00
		054	750.50
		Sub-Total	**5803.90**
	Parwati	055	954.20
		056	118.20
		057	492.90
		058	479.90
		059	484.70
		060	211.80
		061	116.70
		062	157.40
		063	126.60
		064	110.40
		065	89.00
		066	1314.80
		067	364.20
		Sub-Total	**5020.80**
Total			**31242.50**

Chambal Basin falls in eleven Districts of Rajasthan namely: Baran (22.43%), Bhilwara (3.35%), Bundi (17.96%), Chittaurgarh (7.01%), Dhaulpur (2.66%), Jhalawar (20.22%), Karauli (2.62%), Kota (16.41%), Pratapgarh (2.87%), Sawai Madhopur (3.08%) and Tonk (1.38%). Maximum area of Chambal Basin is covered by Baran District followed by Jhalawar District.

Weather statistics for Chambal Basin have been analysed and presented in Table 5.17 based on the 20 years (1990-2009) monthly IMD weather data except for

rainfall analysis, which is based on IMD, RD and WRD data of 54 years (1957-2010). The statistical values presented in Table 5.17 are the values which varies spatially over the region i.e. they signify the spatial variation of a weather parameter over the basin.

Table 5.17: Weather Parameter Statistics for Chambal Basin

Weather Parameter	Minimum	Maximum	Mean	Standard Deviation	Coefficient of Variation
Mean Maximum Temperature, °C	32.10	33.90	32.90	0.24	0.01
Highest Maximum Temperature, °C	44.67	47.10	45.88	0.40	0.01
Mean Minimum Temperature, °C	18.05	21.90	19.86	0.54	0.03
Lowest Minimum Temperature, °C	2.93	7.60	5.11	0.76	0.15
Annual Rainfall, mm	574.90	984.60	784.90	87.90	0.11
Monsoon Months Rainfall, mm	530.20	925.10	732.40	85.10	0.12
Rainy Days, Days/yr	28.00	40.00	34.00	2.40	0.07
Wind Speed, Km/hr	1.42	6.50	4.46	0.86	0.19
Sunshine Hours, hr/day	7.97	8.25	8.09	0.06	0.01
Relative Humidity, %	44.10	55.90	51.29	2.24	0.04
Annual Evaporation, cm	187.00	219.26	206.47	5.37	0.03

Source: IMD monthly dataset (1990-2009); Rainfall statistics based on IMD, RD and WRD dataset (1957-2010)

Mean Annual Rainfall in Chambal Basin is 784.90 mm. Highest maximum temperature ranges from 44.67-47.10°C with a mean value of 45.88°C, while Lowest minimum temperature ranges from 2.93-7.60°C with a mean value of 5.11°C.

Chambal Basin has 6 Major, 22 Medium and 223 Minor existing projects with cumulative live storage capacity of 1,946.98 Mm^3, 631.44 and 472.78 Mm^3, respectively. The approximate water storage capacity of 9,537 WHSs in basin is 272.92 Mm^3. The salient features of existing projects are given in Appendix 4. There are 14 ongoing and 23 proposed projects in Chambal basin, salient features of which are given in Appendix 5. In addition to this, Chambal basin gets imported surface water as per inter-state agreement which is shared at Kota Baggare, details of which are given in Chapter 12.

5.10 Mahi Basin

Mahi River descends from the northern slopes of the Vindhyachal ranges in MP at an elevation of 500 m amsl. It flows southwards for about 120 kms in MP before entering Banswara District of Rajasthan. The river takes a 'U' shaped route in Rajasthan before entering Gujarat, finally discharging into the Gulf of Cambay.

The Mahi Basin having catchment area of 16,611 km^2 in Rajasthan lies between longitudes 73°18' and 74°52' and latitudes 23°04' and 24°35'. The main tributaries of the Mahi are Eru, Nori, Chap, Som, Jakham, Moran, Anas and Bhadar.

Most of Mahi Basin lies in a hilly tract which may be characterised by rocky uplands in the form of minor hill ranges, erosional valleys, generally long, narrow and shallow, and undulating or rolling erosional pediplains.

There are 6 sub-basins in Mahi Basin namely Anas, Bhadar, Jakham, Moran, Som, and Mahi have catchment areas of 1,411.38 km^2, 280.57 km^2, 2,320.58 km^2, 5,699.18 km^2, 678.57 km^2, 6,220.35 km^2 respectively, within Rajasthan. More details are given in Volume 2b and Volume 3b of Final Report No. 4.2.

A brief description of important tributaries is given in following paragraphs.

Som River

River Som originates in the hills near the village Som in Kherwara Tehsil of Udaipur District. It flows southeast through a hilly region and joins river Mahi near the village Baneshwar. The entire catchment lies in Udaipur and Dungarpur. The main tributaries of river Som are Tidi, Gomti and Jakham.

Jakham River

River Jakham originates southwest of the hills near Chotti Sadari in Chittorrgarh District. It flows through the hilly region of Udaipur District in a south-western direction and joins river Som near Bilara village. The Sub-Basin is situated in Chittor and Udaipur. The main tributaries of river Jakham are Karmai and Sukli.

Moran River

River Moran originates in the southern hills of Dungarpur town. It flows through Dungarpur District and joins Mahi river near Galiakot village. The total catchment of river lies in Dungarpur.

Anas River

River Anas originates in the northern slopes of the Vindhyan ranges, near Amber village in MP. It flows in a north-western direction, enters Rajasthan near Meledikhera village and joins Mahi river about 15 km downstream of Galiakot village. The Sub-Basin in Rajasthan is situated in Banswara District. The main tributary of Anas river in Rajasthan is Hiran.

Bhadar River

The river Bhadar, originating in the hills south of Kanguwa village in Dungarpur District, flows from north to south and enters Gujarat near Kokhakra village in Dungarpur District, where it joins the Mahi near Karanta village in Gujarat.

There are 59 micro-watersheds delineated in Mahi Basin within Rajasthan boundary.

Table 5.18: Area Details of Mahi Basin

Basin	Sub-basin	Micro-watershed Code	Area, Km²
Mahi	Anas	001	417.27
		002	223.86
		003	224.08
		004	546.17
		Sub-Total	**1411.38**
	Bhadar	005	280.57
		Sub-Total	**280.57**
	Jakham	006	55.60
		007	272.72
		008	91.95
		009	188.45
		010	191.22
		011	215.92
		012	178.00
		013	311.64
		014	191.59
		015	171.13
		016	229.99
		017	222.38
		Sub-Total	**2320.59**
	Mahi	018	234.14
		019	461.57
		020	425.13
		021	91.96
		022	503.17
		023	327.10
		024	458.83
		025	509.89
		026	185.55
		027	221.34
		028	422.02
		029	260.01
		030	60.47
		031	155.09
		032	245.60
		033	242.83
		034	377.89
		035	32.30
		036	154.16
		037	330.12
		Sub-Total	**5699.17**
	Moran	038	678.57
		Sub-Total	**678.57**
	Som	039	77.04
		040	331.99
		041	475.47
		042	228.83
		043	229.40
		044	394.31
		045	318.73

Basin	Sub-basin	Micro-watershed Code	Area, Km²
		046	376.47
		047	250.63
		048	274.92
		049	221.91
		050	395.64
		051	484.09
		052	257.70
		053	297.33
		054	379.10
		055	334.80
		056	133.63
		057	346.85
		058	302.56
		059	108.95
		Sub-Total	**6220.35**
Total			**16610.63**

Mahi Basin falls in five Districts of Rajasthan namely: Banswara (26.99%), Chittaurgarh (1.12%), Dungarpur (19.03%), Pratapgarh (20.29%) and Udaipur (32.56%). Maximum area of Mahi Basin is covered by Udaipur District followed by Banswara District.

Weather statistics of Mahi Basin have been analysed based on the 20 years (1990-2009) monthly IMD weather data except for rainfall analysis which is based on IMD, RD and WRD data of 54 years (1957-2010) and presented in Table 5.19. The statistical values presented in Table 5.19 are the values which varies spatially over the region i.e. they signify the spatial variation of a weather parameter over the basin.

Table 5.19: Weather Parameter Statistics of Mahi Basin

Weather Parameter	Minimum	Maximum	Mean	Standard Deviation	Coefficient of Variation
Mean Maximum Temperature, °C	31.32	33.60	32.82	0.47	0.01
Highest Maximum Temperature, °C	42.48	45.00	44.36	0.48	0.01
Mean Minimum Temperature, °C	17.11	20.80	19.20	0.94	0.05
Lowest Minimum Temperature, °C	1.93	8.30	5.10	1.84	0.36
Annual Rainfall, mm	510.80	1,042.90	753.10	123.90	0.16
Monsoon Months Rainfall, mm	487.30	986.90	712.00	119.00	0.17
Rainy Days, Days/yr	4.00	40.00	32.00	4.00	0.00
Wind Speed, km/hr	4.20	8.41	5.47	0.79	0.14
Sunshine Hours, hr/day	8.24	8.34	8.29	0.02	0.00
Relative Humidity, %	50.29	54.36	52.90	0.66	0.01
Annual Evaporation, cm	197.64	222.90	211.68	7.21	0.03

Source: IMD monthly dataset (1990-2009); Rainfall statistics based on IMD, RD and WRD dataset (1957-2010)

Mean Annual Rainfall in Mahi Basin is 753.10 mm. Highest maximum temperature ranges from 42.48-45.00°C with a mean value of 44.36°C, while Lowest minimum temperature ranges from 1.93–8.30°C with a mean value of 5.10°C.

Mahi Basin has 4 Major, 2 Medium and 271 Minor existing projects with cumulative live storage capacity of 2,422.40 Mm^3, 45.77 Mm^3 and 361.14 Mm^3, respectively. The approximate water storage capacity of 4,997 WHSs in basin within Rajasthan boundary is 249.00 Mm^3. The salient features of existing projects are given in Appendix 4. There are 3 ongoing and 9 proposed projects in Mahi basin, salient features of which are given in Appendix 5. In addition to this, Mahi basin gets imported surface water as per inter-state agreement which is shared at Mahi Bajaj Sagar, details of which are given in Chapter 12.

5.11 Sabarmati Basin

Sabarmati River and its tributaries descend from the Aravali hills and drain the slopes of the Aravali hills in Udaipur District. The Vatrak River, a tributary of Sabarmati River, flows through Dungarpur District, roughly marking the western boundary of Udaipur District, and flows in a south-westerly direction. The main tributaries of Sabarmati River are Wakal River and Sei Nadi, which also originate from the Aravali hill range west of Udaipur city and flow south-westwards. Their courses are generally parallel to the Sabarmati River, up to their confluence with the Sabarmati in Gujarat.

The hills are part of the Aravali range, and in conformity with the general trend in the range, run mostly north-east-south-west as a broken chain of hills elongated in shape and parallel to each other. Almost the entire western half of the basin is made up of these sub-ranges. In addition, there are isolated hillocks, the eroded remnants of earlier hill ranges, aligned parallel to the sub-ranges. The maximum elevation in the hilly terrain is more than 800 m, the highest peak near the source of the Sabarmati is about 1,173 m amsl.

The Sabarmati Basin is situated in the southern part the State of Rajasthan within the Aravalli hill range to the west of the Districts of Udaipur and Dungarpur. It covers an area of 4,130.12 km^2 in Rajasthan.

There are four Sub-basins in Sabarmati Basin within Rajasthan namely Sabarmati (857.43 km^2), Sei (651.60 km^2), Vatrak (770.52 km^2) and Wakal (1,850.55 km^2). More details are given in Volume 2b and Volume 3b of Final Report No. 4.2.

A brief description of the tributaries of River Sabarmati is given in the following paragraphs.

Wakal River

River Wakal originates northwest of Udaipur, near Suran village. The river flows in a generally south direction up to Manpur village in Udaipur District, where it turns northeast, and after a distance of about 90 km, leaves Rajasthan near the Goupipli village, and joins Sabarmati river near Eitarwar village in Gujarat.. The main tributaries of Wakal are Manshi and Parvi rivers.

Vatrak River

River Vatrak originates in the hills east of Jothri village in Dungarpur District, flows generally westwards, enters Gujarat near Mandli village in Dungarpur District, and finally joins Sabarmati river in Gujarat.

Sei River

River Sei originates in the western slopes of the Aravalli range near Padrana village in Udaipur District, flows southwest for about 74 km in Rajasthan to enter Gujarat near Khajuria village in Udaipur District, and joins Sabarmati river near Dother village in Gujarat, after flowing for about 29 km.

There are 15 micro-watersheds delineated in Sabarmati Basin within Rajasthan boundary.

Table 5.20: Area Details of Sabarmati Basin

Basin	Sub-basin	Micro-watershed Code	Area, Km²
Sabarmati	Sabarmati	001	176.05
		002	264.77
		003	45.74
		004	191.97
		005	178.90
		Sub-Total	**857.43**
	Sei	006	396.27
		007	255.33
		Sub-Total	**651.60**
	Vatrak	008	274.06
		009	496.46
		Sub-Total	**770.52**
	Wakal	010	177.76
		011	316.48
		012	293.46
		013	410.53
		014	406.14
		015	246.18
		Sub-Total	**1850.55**
Total			**4130.12**

Sabarmati Basin falls in four Districts of Rajasthan namely: Dungarpur (14.81%), Pali (0.03%), Sirohi (1.68%) and Udaipur (83.47%). Maximum area of Sabarmati Basin is covered by Udaipur District followed by Dungarpur District.

Weather statistics of Sabarmati Basin have been analysed based on the 20 years (1990-2009) monthly IMD weather data except for rainfall analysis which is based on IMD, RD and WRD data of 54 years (1957-2010) and presented in Table 5.21. The statistical values presented in Table 5.21 are the values which varies spatially over the region i.e. they signify the spatial variation of a weather parameter over the basin.

Table 5.21: Weather Data Statistics for Sabarmati Basin

Weather Parameter	Minimum	Maximum	Mean	Standard Deviation	Coefficient of Variation
Mean Maximum Temperature, ºC	28.40	32.70	31.48	0.75	0.02
Highest Maximum Temperature, ºC	38.99	44.17	42.59	0.93	0.02
Mean Minimum Temperature, ºC	14.26	19.14	17.20	0.85	0.05
Lowest Minimum Temperature, ºC	-0.77	5.07	1.98	1.10	0.56
Annual Rainfall, mm	604.40	787.40	684.40	49.20	0.07
Monsoon Months Rainfall, mm	568.20	753.00	649.10	49.40	0.08
Rainy Days, Days/hr	28.00	35.00	32.00	1.60	0.05
Wind Speed, km/hr	3.27	6.88	5.02	0.69	0.14
Sunshine Hours, hr/day	8.31	8.37	8.35	0.02	0.00
Relative Humidity, %	52.04	58.54	54.43	1.20	0.02
Annual Evaporation, cm	164.93	212.29	194.41	9.71	0.05

Source: IMD monthly dataset (1990-2009); Rainfall Statistics based on IMD, RD and WRD dataset (1957-2010)

Mean Annual Rainfall in Sabarmati Basin is 684.40 mm. Highest maximum temperature ranges from 38.99-44.17°C with a mean value of 42.59°C, while Lowest minimum temperature ranges from (-)0.77–5.07°C with a mean value of 1.98°C.

Sabarmati basin has no Major/Medium projects and 54 Minor existing projects with cumulative live storage capacity of 118.06 Mm^3. The approximate water storage capacity of 882 WHSs is 45.67 Mm^3. The salient features of existing projects are given in Appendix 4. There are 2 ongoing and 3 proposed projects in Sabarmati basin, salient features of which are given in Appendix 5.

5.12 Luni Basin

Luni River originates from the western slopes of the Aravali range at an elevation of 550 m amsl, near Ajmer. After flowing for about 495 kms in a south-westerly direction in Rajasthan, the River disappears in the marshy land of Rann of Kutch. Luni Basin catchment area in Rajasthan is 69,302 km^2 and it covers parts of districts of Ajmer, Barmer, Bhilwara, Jaisalmer, Jalore, Jodhpur, Nagaur, Pali Rajsamand, Sirohi and Udaipur between latitudes 23°41' and 27°05' and longitudes 71°04' and 74°42'.

The water of Luni River is fresh up to Balotra but becomes more and more saline further downstream. The main tributaries of Luni on the left are Sukri, Mithri, Bandi, Khari, Jawai, Guhiya, Sagi and Jojari River is the only one joining it on the right side.

Topography of Luni Basin varies from plain areas occupying the western part characterised by flat, sandy terrain, to mountainous areas in the east, made up of a variety of igneous rocks, including some Limestone outcrops.

There are 12 Sub-basins in Luni Basin namely Bandi (770.11 Km^2), Bandi (Hemawas) 1,649.30 Km^2, Guhiya 3,854.20 Km^2, Jawai 2,640.50 Km^2, Jojri

7,046.00 Km^2, Khari 2,638.30 Km^2, Khari (Hemawas) 1,098.60 Km^2, Luni 42,521.10 Km^2, Mithari 1,702.70 Km^2, Sagi 1,218.70 Km^2, Sukri 3,166.60 Km^2, Sukri Sayala 995.70 Km^2. More details are given in Volume 2c and Volume 3c of Final Report No. 4.2.

A brief description of important tributaries of the Luni river is given below.

Guhiya River

River Guhiya originates in the hillocks near the villages Khariyaniv and Tharasani in Pali District. It joins river Bandi near village Phekariya in Pali District. The catchment is situated in Pali district. The main tributaries of Guhiya are Raipur Luni, Radia Nadi, Guria Nadi, Lilri Nadi, Sukri and Phunpharia Bala.

Khari (Hemawas) River

River Khari is formed by the confluence of small streams namely Somesar and Khari Kherwa. River Somesar (originally known as Sumer Nadi) originates in the western slopes of the Aravali range near the village Somesar in Pali District. The stream Umrawas Ka Nalla, originating in the western slopes of the Aravali, near village Kanklawas, joins Sumer Nadi. Kotki Nadi, originating from Dewair Reserved Forest Bhakar also joins Sumer Nadi after flowing for about 30 km. After joining of all these small streams, the river is called Khari. It joins Bandi river downstream of Hemawas reservoir after flowing for about 25 km.

Bandi (Hemawas) River

Khari and Mithari rivers join near Bombadra pickup weir and form the Bandi River. It joins the Luni near the village Lakhar, in Pali District, after flowing for about 45 km. The catchment is situated in Pali District.

Mithari River

River Mithari originates in the south-western slopes of the Aravali range in Pali District by confluence of local nallahs. The river flows through Jawai, Bali and Falna Districts for about 80 km in a north-west direction before vanishing in sandy plains near village Sankhwal in Jalore district. The catchment extends over parts of Pali and Jalore Districts.

Sukri River

River Sukri is formed by the confluence of several small nallahs - Ghanerav Nadi, Muthana ka Bala, Magai Nadi etc., originating from the Aravalis in Pali and Udaipur Districts. It flows for about 110 km in a south-east to north-west direction, and feeds Bankli Dam on the way. It joins River Luni near the village Samdari in Barmer District. This Sub-Basin covers parts of Jalore, Pali and Barmer Districts.

Jojari River

River Jojari originates in the hillocks near village Pondlu in Nagaur District, it flows for about 83 km from north-east to south-west before joining Luni river near the village Khejadli Khurd in Jodhpur District. The catchment extends over Jodhpur

and Nagaur Districts. A number of small streams join this river in the upper reaches.

Jawai River

River Jawai, and its main tributary Sukari, originate in the western slopes of the Aravalis, in Udaipur District. The river flows generally in a north-west direction for about 96 km, before joining River Khari near the village Sayala in Jalore District.

Khari River

River Khari originates in the south-western slopes of the Aravali hills, near Shergaon village in Sirohi District. It flows north-west for about 64 km before joining the Sukri river near Sayala village in Jalore District. The catchment extends Sirohi and Jalore Districts. The main tributaries of the Khari river are Krishnawati and Kameri.

Sukri River (Sayala to Luni)

River Jawai, after its confluence with the Khari river is called Sukri. It flows in a southwest direction for about 80 km before joining the Luni river near Golia village. The catchment extends over parts of Jalore and Barmer Districts.

Bandi River

River Bandi is formed by the confluence of Kapal Ganga Nadi, originating in the hills near village Seankra, and Jaswantpura Nallah, originating in the hills near Nivaj village in Sirohi District. It flows generally in a northwest direction for about 65 km and finally vanishes in the west.

Sagi River

River Sagi originates in the south-western slopes of Jaswantpura hills in Jalore District. It flows initially for about 72 km northwest and then southwest before joining the Luni near Gandhav village in Barmer District. Kari Nadi is the only tributary of River Sagi. The catchment extends over parts of Jalore and Barmer Districts.

There are 94 micro-watersheds delineated in Luni Basin within Rajasthan boundary.

Table 5.22: Area Details of Luni Basin

Basin	Sub-basin	Micro-watershed Code	Area, Km^2
Luni	Bandi	001	336.30
		002	268.30
		003	165.50
		Sub-Total	**770.10**
	Bandi (Hemawas)	004	1130.20
		005	519.10
		Sub-Total	**1649.30**
	Guhiya	006	434.30
		007	290.90
		008	913.60

Basin	Sub-basin	Micro-watershed Code	Area, Km^2
		009	155.70
		010	462.20
		011	1183.70
		012	60.80
		013	353.00
		Sub-Total	**3854.20**
	Jawai	014	1485.80
		015	443.10
		016	711.60
		Sub-Total	**2640.50**
	Jojri	017	893.90
		018	630.00
		019	241.60
		020	172.30
		021	382.90
		022	389.70
		023	947.30
		024	213.30
		025	1596.80
		026	623.70
		027	440.20
		028	514.30
		Sub-Total	**7046.00**
	Khari	029	326.80
		030	1569.70
		031	352.20
		032	229.60
		033	160.00
		Sub-Total	**2638.30**
	Khari (Hemawas)	034	28.60
		035	63.00
		036	568.50
		037	438.50
		Sub-Total	**1098.60**
	Luni	038	929.90
		039	614.60
		040	794.30
		041	959.20
		042	511.40
		043	253.50
		044	765.70
		045	650.80
		046	496.60
		047	2147.80
		048	496.30
		049	1285.10
		050	1853.20
		051	934.40
		052	1156.00
		053	683.50
		054	462.30
		055	1069.60

Basin	Sub-basin	Micro-watershed Code	Area, Km²
		056	125.40
		057	512.30
		058	486.60
		059	959.20
		060	1070.60
		061	473.30
		062	2531.30
		063	673.20
		064	2029.50
		065	2567.80
		066	1014.10
		067	384.10
		068	899.10
		069	748.80
		070	1011.90
		071	408.70
		072	457.90
		073	508.70
		074	418.00
		075	399.50
		076	299.50
		077	2901.20
		078	291.50
		079	626.70
		080	516.10
		081	1153.80
		082	591.20
		083	737.00
		084	1660.90
		Sub-Total	**42522.10**
	Mithari	085	1093.30
		086	609.40
		Sub-Total	**1702.70**
	Sagi	087	1076.60
		088	142.10
		Sub-Total	**1218.70**
	Sukri	089	443.10
		090	817.80
		091	1275.60
		092	350.30
		093	279.80
		Sub-Total	**3166.60**
	Sukri (Sayala)	094	995.70
		Sub-Total	**995.70**
Total			**69302.10**

Luni Basin falls in eleven Districts of Rajasthan namely: Ajmer (2.80%), Barmer (31.07%), Bhilwara (0.004%), Jaisalmer (2.81%), Jalore (12.82%), Jodhpur (19.75%), Nagaur (9.06%), Pali (17.84%), Rajsamand (0.58%), Sirohi (3.00%) and Udaipur (0.26%). Maximum area of Luni Basin is covered by Barmer District followed by Jodhpur District.

Weather statistics of Luni Basin have been analysed based on the 20 years (1990-2009) monthly IMD weather data except for rainfall analysis which is based on IMD, RD and WRD data of 54 years (1957-2010) and presented in Table 5.23. The statistical values presented in Table 5.23 are the values which varies spatially over the region i.e. they signify the spatial variation of a weather parameter over the basin.

Table 5.23: Weather Parameter Statistics for Luni Basin

Weather Parameter	Minimum	Maximum	Mean	Standard Deviation	Coefficient of Variation
Mean Maximum Temperature, °C	26.83	35.00	33.51	0.81	0.02
Highest Maximum Temperature, °C	37.20	46.70	44.84	1.03	0.02
Mean Minimum Temperature, °C	12.81	20.90	19.22	0.90	0.05
Lowest Minimum Temperature, °C	-2.05	6.00	3.48	0.99	0.28
Annual Rainfall, mm	221.50	1,048.10	388.20	104.20	0.27
Monsoon Months Rainfall, mm	191.60	1,007.70	358.10	99.80	0.28
Rainy Days, Days/yr	12.00	38.00	19.00	3.90	0.20
Wind Speed, km/hr	1.90	7.16	4.38	0.96	0.22
Sunshine Hours, hr/day	7.98	8.61	8.39	0.09	0.01
Relative Humidity, %	43.50	60.54	49.19	3.23	0.07
Annual Evaporation	141.10	263.58	216.23	24.46	0.11

Source: IMD monthly dataset (1990-2009); Rainfall statistics based on IMD,RD and WRD dataset (1957-2010)

Mean Annual Rainfall in Luni Basin is 388.20 mm. Highest maximum temperature ranges from 37.20-46.70°C with a mean value of 44.84°C, while Lowest minimum temperature ranges from (-)2.05–6.00°C with a mean value of 3.48°C.

Luni basin has 2 Major, 11 Medium and 721 Minor existing projects with cumulative live storage capacity of 282.13 Mm^3, 260.36 Mm^3 and 558.74 Mm^3, respectively. The approximate water storage capacity of 13,478 WHSs in basin is 381.66 Mm^3. The salient features of existing projects are given in Appendix 4. There is 1 ongoing and 1 proposed project in Luni basin, salient features of which are given in Appendix 5. In addition to this, Luni basin gets imported surface water through Narmada Canal, details of which are given in Chapter 12.

5.13 West Banas Basin

River West Banas originates in the hills south of Sirohi (24°49':72°48') and Pindwara (24°47':73°03'), and flows through a valley carved between the Sirohi-Mount Abu hill range on its eastern bank and the Aravali hill range extending south of Pindwara town. It flows for a distance of about 50 kms in Rajasthan. The river has a number of tributaries, the major ones being Dharvol Nadi, Gohlen Nadi, Kukri Nadi and Sukli Nadi, all originating in the hills north-east of Sirohi town.

West Banas Basin represents a trellis drainage pattern, with West Banas River and Sukli River being subsequent streams, which appear to have adjusted themselves to

the Phulad Lineament and the Pali Lineament, respectively. The first and second order streams are, however, consequent streams laid down in a dendritic pattern.

The West Banas Basin occupies southern part of western Rajasthan and is located in the west of Aravalli hill range. It occupies an area of 1,831.34 km^2 in Rajasthan. More details are given in Volume 2c and Volume 3c of Final Report No. 4.2.

There are 14 micro-watersheds delineated in West Banas Basin within Rajasthan boundary.

Table 5.24: Area Details of West Banas Basin

Basin	Sub-basin	Micro-watershed Code	Area, Km^2
West Banas	West Banas	001	207.24
		002	227.97
		003	161.63
		004	161.82
		005	101.89
		006	133.63
		007	111.34
		008	146.46
		009	115.33
		010	94.39
		011	142.71
		012	26.25
		013	99.01
		014	101.67
Total			**1,831.34**

West Banas Basin falls in three Districts of Rajasthan namely: Pali (0.16%), Sirohi (99.67%) and Udaipur (0.17%). Most area of West Banas Basin is covered by Sirohi District.

Weather statistics for West Banas Basin have been analysed based on the 20 years (1990-2009) monthly IMD weather data except for rainfall analysis, which is based on IMD, RD and WRD data of 54 years (1957-2010) and are presented in Table 5.25. The statistical values presented in Table 5.25 are the values which varies spatially over the region i.e. they signify the spatial variation of a weather parameter over the basin.

Table 5.25: Weather Parameter Statistics for West Banas Basin

Weather Parameter	Minimum	Maximum	Mean	Standard Deviation	Coefficient of Variation
Mean Maximum Temperature, °C	25.90	32.32	28.54	1.78	0.06
Highest Maximum Temperature, °C	36.20	42.85	39.03	1.87	0.05
Mean Minimum Temperature, °C	12.00	17.22	14.26	1.48	0.10
Lowest Minimum Temperature, °C	-2.70	1.21	-0.89	1.13	-1.27
Annual Rainfall, mm	599.30	1553.50	817.60	178.60	0.22
Monsoon Months Rainfall, mm	557.40	1508.50	779.80	177.30	0.23
Rainy Days, Days/yr	25.00	50.00	33.00	4.20	0.13
Wind Speed, km/hr	2.43	4.20	3.49	0.42	0.12
Sunshine Hours, hr/day	8.36	8.39	8.37	0.01	0.00
Relative Humidity, %	55.97	61.50	58.87	1.58	0.03

Weather Parameter	Minimum	Maximum	Mean	Standard Deviation	Coefficient of Variation
Annual Evaporation	150.86	188.85	174.52	9.78	0.06

Source: IMD monthly dataset (1990-2009); Rainfall Statistics based on IMD, RD and WRD dataset (1957-2010)

Mean Annual Rainfall in West Banas Basin is 817.60 mm. Highest maximum temperature ranges from 36.20-42.85°C with a mean value of 39.03°C, while Lowest minimum temperature ranges from (-)2.70–1.21°C with a mean value of (-)0.89°C.

West Banas Basin has 1 Medium and 25 Minor existing projects with cumulative live storage capacity of 36.25 Mm^3 and 46.43 Mm^3, respectively. The approximate water storage capacity of 548 WHSs in basin is 38.60 Mm^3. The salient features of existing projects are given in Appendix 4. There is 1 ongoing and 1 proposed project in West Banas basin, salient features of which are given in Appendix 5.

5.14 Sukli Basin

Sukli River (also known as Sipu) originates in the hills near Mera village southwest of Sirohi. It flows in a northeast-southwest direction, parallel to Mount Abu hill ranges, for about 45 km up to Khera village in Sirohi District, and finally joins West Banas River near Davas village in Gujarat State. The main Nallahs joining Sukli River are Udwaria, Tokra, Nagani, Dabari, Sillinadi, Butri and Mandar. The catchment area of Sukli Basin is 990 km^2 and lies in Sirohi District in Rajasthan, between latitudes 24°25' and 24°47' and longitudes 72°20' and 72°49'.

Offshoots of the Aravali range, running in a northeast-southwest direction, situated in the eastern-south-eastern part of Pindwara, and south of Sirohi, are the main hilly features of this basin. The terrain bounded by the hills forms and plains, has a moderate slope towards the south. The area west of Jaswantpura hills is mainly occupied by undulating sandy terrain, marked by sand fills and depressions. The geological sequence consists of Rhyolitic Lavas, Granites, Gneiss, Phyllites & Schists, Wind Blown Sand (Sand Dunes), Alluvial Sand, Silt and Clay etc. More details are given in Volume 2c and Volume 3c of Final Report No. 4.2.

There are 11 micro-watersheds delineated in Sukli Basin within Rajasthan boundary. Sukli Basin falls entirely in Sirohi District.

Table 5.26: Area Details of Sukli Basin

Basin	Sub-basin	Micro-watershed Code	Area, Km^2
Sukli	Sukli	001	36.00
		002	67.64
		003	133.90
		004	212.39
		005	95.09
		006	128.59
		007	96.90
		008	51.92
		009	79.51

Basin	Sub-basin	Micro-watershed Code	Area, Km²
		010	52.67
		011	35.83
Total			**990.44**

Weather statistics for Sukli Basin have been analysed based on the 20 years (1990-2009) monthly IMD weather data except for rainfall analysis which is based on IMD, RD and WRD data of 54 years (1957-2010) and presented in 5.27. The statistical values presented in Table 5.27 are the values which varies spatially over the region i.e. they signify the spatial variation of a weather parameter over the basin.

Table 5.27: Weather Parameter Statistics for Sukli Basin

Weather Parameter	Minimum	Maximum	Mean	Standard Deviation	Coefficient of Variation
Mean Maximum Temperature, ºC	25.90	28.79	27.24	0.75	0.03
Highest Maximum Temperature, ºC	36.20	39.38	37.67	0.83	0.02
Mean Minimum Temperature, ºC	12.00	14.59	13.20	0.68	0.05
Lowest Minimum Temperature, ºC	-2.70	-0.50	-1.70	0.57	-0.34
Annual Rainfall, mm	546.60	1,552.70	948.50	214.60	0.23
Monsoon Months Rainfall, mm	514.80	1,507.70	910.40	211.90	0.23
Rainy Days, Days/yr	22.00	50.00	35.00	5.90	0.17
Wind Speed, Km/hr	3.16	3.91	3.55	0.17	0.05
Sunshine Hours, hr/day	8.37	8.38	8.38	0.00	0.00
Relative Humidity, %	58.11	61.50	59.99	0.87	0.01
Annual Evaporation	171.00	190.63	182.31	5.10	0.03

Source: IMD monthly dataset (1990-2009); Rainfall Statistics based on IMD, RD and WRD dataset (1957-2010)

Mean Annual Rainfall in Sukli Basin is 948.50 mm. Highest maximum temperature ranges from 36.20-39.38°C with a mean value of 37.67°C, while Lowest minimum temperature ranges from (-)2.70–(-)0.50°C with a mean value of (-)1.70°C.

Sukli Basin has 1 Medium and 16 Minor existing projects with cumulative live storage capacity of 25.58 Mm^3 and 35.54 Mm^3, respectively. The approximate water storage capacity of 545 WHSs in basin is 16.51 Mm^3. The salient features of existing projects are given in Appendix 4. There is 1 proposed project in Sukli basin, salient features of which are given in Appendix 5.

5.15 Other Nallahs of Jalore Basin

Other Nallahs of Jalore Basin includes streams and Nallahs originating in the western slopes of Jaswantpura hills (24º48':72º28') and Silar hills (24º42':72º28'). The Baragaon Nadi and Sukal River, along with the other Nallahs, originate in the sand dune terrain around Raniwara (24º45':72º12'). The Bargaon Nadi and Sukal River also follow courses generally parallel or sub-parallel to the Sukli and West Banas Rivers within Rajasthan.

The basin is a small basin with an area of 1,900.27 km^2 in Jalore District within Rajasthan located in the south-western part of the State. It is surrounded by Luni basin in the north and west and by Sukli basin in the east. The southern limit is marked by State boundary with Gujarat State. More details are given in Volume 2c and Volume 3c of Final Report No. 4.2.

The main hill features are the hill ranges running north-east - south-west in the eastern - south-eastern part of Pindwara area and that south of Sirohi. They are all off-shoots of the Aravali and attain a maximum height of about 1,100 m amsl in the Pindwara hills and 1,722 m amsl in the Mt. Abu hills south of Sirohi. The terrain bounded by the Sirohi hills in the east, and the Jaswantpura and Silari hills in the west, takes the form of a plain at an elevation ranging from about 300 to 400 m amsl, having a moderate slope towards the south, with local exceptions.

The area west of the Jaswantpura and Silari hills is essentially occupied by undulating sandy terrain, marked by sand hills and depressions (as well as some relict hills).

There are 9 micro-watersheds delineated in Other Nallahs of Jalore Basin within Rajasthan boundary.

Table 5.28: Area Details of Other Nallahs of Jalore Basin

Basin	Sub-basin	Micro-watershed Code	Area, Km^2
Other Nallahs of Jalore	Other Nallahs of Jalore	001	236.73
		002	238.53
		003	252.24
		004	135.89
		005	265.21
		006	185.89
		007	384.51
		008	73.41
		009	127.86
Total			**1,900.27**

Other Nallahs of Jalore Basin falls in two Districts of Rajasthan namely: Jalore (91.29%) and Sirohi (8.71%).

Weather statistics for Other Nallahs of Jalore Basin have been analysed based on the 20 years (1990-2009) monthly IMD weather data except for rainfall analysis which is based on IMD, RD and WRD data of 54 years (1957-2010) and is presented in Table 5.29. The statistical values presented in Table 5.29 are the values which varies spatially over the region i.e. they signify the spatial variation of a weather parameter over the basin.

Table 5.29: Weather Parameter Statistics for Other Nallahs of Jalore Basin

Weather Parameter	Minimum	Maximum	Mean	Standard Deviation	Coefficient of Variation
Mean Maximum Temperature, °C	28.60	32.80	31.40	1.10	0.03
Highest Maximum Temperature, °C	39.10	44.00	42.40	1.30	0.03
Mean Minimum Temperature, °C	14.40	18.50	17.10	1.00	0.06

Weather Parameter	Minimum	Maximum	Mean	Standard Deviation	Coefficient of Variation
Lowest Minimum Temperature, °C	-0.70	2.90	1.70	0.90	0.56
Annual Rainfall, mm	498.50	749.90	590.70	48.60	0.08
Monsoon Months Rainfall, mm	467.80	713.90	557.70	47.50	0.09
Rainy Days, Days/yr	21.00	29.40	24.30	1.50	0.06
Wind Speed, Km/hr	3.40	4.20	3.90	0.20	0.05
Sunshine Hours, hr/day	8.40	8.40	8.40	0.00	0.00
Relative Humidity, %	51.50	58.50	54.40	1.80	0.03
Annual Evaporation, cm	184.60	212.00	201.10	6.90	0.03

Source: IMD monthly dataset (1990-2009); Rainfall Statistics based on IMD, RD and WRD dataset (1957-2010)

Mean Annual Rainfall in Other Nallahs of Jalore Basin is 590.70 mm. Highest maximum temperature ranges from 39.10-44.00°C with a mean value of 42.40°C, while Lowest minimum temperature ranges from (-)0.70–2.90°C with a mean value of 1.70°C.

Other Nallahs of Jalore Basin has no Major/Medium projects and 30 Minor existing projects with cumulative live storage capacity of 28.51 Mm^3. The approximate water storage capacity of 610 WHSs in basin is 7.47 Mm^3. The salient features of existing projects are given in Appendix 4. In addition to this, Other Nallahs of Jalore basin gets imported surface water through Narmada Canal, details of which are given in Chapter 12.

5.16 Ghaggar Basin

The north western parts of Rajasthan comprising of the Districts of Hanumangarh and Ganganagar belong to the lower Ghaggar Basin originating from Shivalik hills of Himachal Pradesh (at an elevation 1,927 m amsl). It covers an area of 5,201.51 Km^2 in Rajasthan. Ghaggar River after entering the Haryana State near Kalka (30°51':76°07') traverses through Haryana, Punjab and Rajasthan and enters Pakistan near Anupgarh (29°11':73°12'). It is an ephemeral river receiving copious runoff during monsoon period. During the lean period, significant base flow is generated which is utilised for irrigation by the border areas of States Haryana and Rajasthan. However, most of the runoff is generated up to Sadulgarh (29°41':75°13') beyond which the runoff starts declining indicating influent regime of the River. The hydrological regime of Ghaggar River has undergone changes in the past (before seventh decade) and accordingly, lower Ghaggar River was rarely receiving the flood flows. In the recent past however, due to development of an efficient drainage network in the then undivided Punjab (Haryana and Punjab), lower part of Ghaggar River started receiving floods inundating a large fertile plain. With the passage of time, the flood waters crossed over to Pakistan. The increased flooding of Ghaggar River bed (Nali bed) has great influence on the surface water and groundwater resources of this part of Rajasthan. The available surface water resources of lower Ghaggar River are likely to change in the near future due to extensive rain water harvesting in the upper Ghaggar Basin. More details are given in Volume 2c and Volume 3c of Final Report No. 4.2.

There are 2 micro-watersheds delineated in Ghaggar Basin within Rajasthan boundary.

Table 5.30: Area Details of Ghaggar Basin

Basin	Sub-basin	Micro-watershed Code	Area, Km^2
Ghaggar	Ghaggar	001	2,790.47
		002	2,411.04
Total			**5,201.51**

Ghaggar Basin falls in two Districts of Rajasthan namely: Ganganagar (60.62%) and Hanumangarh (39.38%).

Weather statistics for Ghaggar Basin have been analysed based on the 20 years (1990-2009) monthly IMD weather data except for rainfall analysis which is based on IMD, RD and WRD data of 54 years (1957-2010) and is presented in Table 5.31. The statistical values presented in Table 5.31 are the values which varies spatially over the region i.e. they signify the spatial variation of a weather parameter over the basin.

Table 5.31: Weather Parameters Statistics of Ghaggar Basin

Weather Parameters	Minimum	Maximum	Mean	Standard Deviation	Coefficient of Variation
Mean Maximum Temperature, °C	33.24	33.81	33.47	0.13	0.00
Highest Maximum Temperature, °C	46.38	46.76	46.59	0.08	0.00
Mean Minimum Temperature, °C	18.26	19.02	18.56	0.18	0.01
Lowest Minimum Temperature, °C	1.31	1.97	1.53	0.17	0.11
Annual Rainfall, mm	188.80	264.90	221.70	12.50	0.06
Monsoon Months Rainfall, mm	158.30	210.70	180.60	9.70	0.05
Rainy Days, Days/Year	12.00	15.00	13.00	0.50	0.04
Wind Speed, Km/hr	3.56	4.77	4.08	0.26	0.06
Sunshine Hours, hr/day	7.44	7.74	7.54	0.06	0.01
Relative Humidity, %	49.65	55.79	52.99	1.36	0.03
Annual Evaporation, cm	181.42	210.36	193.51	6.38	0.03

Source: IMD monthly dataset (1990-2009); Rainfall Statistics based on IMD, RD and WRD dataset (1957-2010)

Mean Annual Rainfall in Ghaggar Basin is 221.70 mm. Highest maximum temperature ranges from 46.38-46.76°C with a mean value of 46.59°C, while Lowest minimum temperature ranges from 1.31-1.97°C with a mean value of 1.53°C.

Ghaggar basin has no Major/Medium/Minor existing storage projects. The approximate water storage capacity of 97 WHSs in basin is 41.79 Mm^3. In addition to this, Ghaggar basin gets imported surface water through Bhakra Canal, Gang Canal and Indira Gandhi Nahar Project, details of which are given in Chapter 12.

5.17 Outside Basin

This basin occupies a very large area of 130,522.48 km^2 in the western part of the Rajasthan State and covers entire Districts of Jaisalmer and Bikaner and parts of Districts of Barmer, Jodhpur, Nagaur, Sikar, Ganganagar, Hanumangarh, Jaisalmer, Jhunjhunun and Churu.

The Outside Basin constitutes a closed basin as drainage is not clearly defined, originating and ending within the plain itself. Owing to scanty rainfall, the streams carry only peak flood waters and are ephemeral in nature, while their channels are ill-defined and disappear in the desert after travelling a short distance. There appears to be a subsurface groundwater divide determining the flow directions. This divide has a near east - west trend and passes through Osian town between Nagaur and Jodhpur, and south of Jaisalmer town.

There are no major channels in Bikaner, Churu, Jhunjhunun, Sikar, Nagaur, Jodhpur, Jaisalmer and Barmer Districts. Minor ephemeral streams such as VerNadi and Luniwala originate in the hills around Siwana and elsewhere in Barmer District. In Jaisalmer District, topographic depressions mark seasonal channel courses, including the Lathi, Sukri, Gujri, Baisakhi and Kak. In Jodhpur District, the internal drainage system is represented by its originating between Balesar (26°21':72°19') and Bairu (26°25':72°53'). The Kantli drainage system in Sikar, Jhunjhunun and Churu Districts is not a part of the Outside Basin.

The desert area contains a few natural salt lakes and depressions, e.g. near Gajner (27°58':73°02'), Kolayat (27°50':72°58'), Nal (28°03'30":73°11'30") and Lunkaransar (28°30':73°45') in Bikaner, the Bap in Jodhpur, the Pachpadra in Barmer, and the Rann of Jaisalmer and the Pokran, in Jaisalmer.

Keeping in view the vast area under Outside Basin, the catchments delineated by model are clubbed and have been divided into 6 sub-basins based on DEM generated drainages and 1 Fragmented Sub-basin which does not have a defined flow path. These are, Sub 1 (5,566.27 km^2), Sub 2 (7,517.14 km^2), Sub 3 (23,582.09 km^2), Sub 4 (24,263.67 km^2), Sub 5 (42,264.75 km^2), Sub 6 (25,186.88 km^2) and Fragmented area (2,141.69 km^2). More details are given in Volume 2c and Volume 3c of Final Report No. 4.2.

There are 72 micro-watersheds delineated in Outside Basin within Rajasthan boundary.

Table 5.32: Area Details of Outside Basin

Basin	Sub-basin	Micro-watershed Code	Area, Km^2
Outside Basin	Fragmented	001	504.66
		002	1,637.03
		Sub-Total	**2,141.69**
	Sub 1	003	1,325.99
		004	4,240.28
		Sub-Total	**5,566.27**
	Sub 2	005	1,361.93
		006	6,155.21
		Sub-Total	**7,517.14**
	Sub 3	007	618.83
		008	2,080.35
		009	2,469.42
		010	1,033.25
		011	669.72
		012	2,005.09

Basin	Sub-basin	Micro-watershed Code	Area, Km²
		013	669.25
		014	1,259.87
		015	2,473.25
		016	591.09
		017	2,106.30
		018	391.43
		019	2,576.78
		020	3,619.60
		021	787.34
		022	230.52
		Sub-Total	**23582.09**
	Sub 4	023	927.95
		024	3,047.40
		025	1,789.47
		026	4,186.83
		027	2,802.93
		028	1,283.93
		029	2,987.89
		030	1,818.90
		031	1,596.78
		032	3,821.59
		Sub-Total	**24,263.67**
	Sub 5	033	1,673.45
		034	1,780.61
		035	2,530.12
		036	1,286.24
		037	7,476.71
		038	6,125.96
		039	3,376.96
		040	796.07
		041	3,732.22
		042	3,235.26
		043	2,383.22
		044	1,871.54
		045	1,992.29
		046	4,004.10
		Sub-Total	**42,264.75**
	Sub 6	047	1,034.56
		048	1,372.10
		049	740.32
		050	620.59
		051	812.31
		052	1,196.11
		053	248.84
		054	562.4
		055	575.38
		056	1,207.11
		057	1,411.92
		058	1,455.23
		059	1,286.38
		060	715.14
		061	1,313.29

Basin	Sub-basin	Micro-watershed Code	Area, Km²
		062	576.23
		063	1,672.50
		064	783.83
		065	1,033.63
		066	837.23
		067	934.82
		068	913.67
		069	697.46
		070	1,070.67
		071	1,189.50
		072	925.66
		Sub-Total	**25,186.88**
Total			**130,522.48**

Outside Basin falls in ten Districts of Rajasthan namely: Barmer (5.29%), Bikaner (23.19%), Churu (10.60%), Ganganagar (5.78%), Hanumangarh (6.03%), Jaisalmer (28.01%), Jhunjhunu (3.17%), Jodhpur (6.88%), Nagaur (7.70%) and Sikar (3.34%). Maximum area of Outside Basin is covered by Jaisalmer District followed by Bikaner District.

Weather statistics for Outside Basin have been analysed based on the 20 years (1990-2009) monthly IMD weather data except for rainfall analysis which is based on IMD, RD and WRD data of 54 years (1957-2010) and is presented in Table 5.33. The statistical values presented in Table 5.33 are the values which varies spatially over the region i.e. they signify the spatial variation of a weather parameter over the basin.

Table 5.33: Weather Parameters Statistics for Outside Basin

Weather Parameter	Minimum	Maximum	Mean	Standard Deviation	Coefficient of Variation
Mean Maximum Temperature, °C	32.60	35.00	33.98	0.42	0.01
Highest Maximum Temperature, °C	44.99	47.40	46.20	0.39	0.01
Mean Minimum Temperature, °C	17.30	20.82	19.19	0.67	0.03
Lowest Minimum Temperature, °C	-0.50	5.31	2.43	1.23	0.51
Annual Rainfall, mm	191.50	564.50	286.10	69.00	0.24
Monsoon Months Rainfall, mm	164.30	482.40	246.40	61.80	0.25
Rainy Days, Days/yr	10.60	30.60	16.50	3.80	0.23
Wind Speed, km/hr	3.20	10.10	5.79	1.56	0.27
Sunshine Hours, hr/day	7.40	8.80	8.22	0.37	0.05
Relative Humidity, %	43.50	57.70	48.13	2.64	0.05
Annual Evaporation, cm	174.10	306.70	232.37	28.68	0.12

Source: IMD monthly dataset (1990-2009); Rainfall Statistics based on IMD, RD and WRD dataset (1957-2010)

Mean Annual Rainfall in Outside Basin is 286.10 mm. Highest maximum temperature ranges from 44.99-47.40°C with a mean value of 46.20°C, while Lowest minimum temperature ranges from (-)0.50–5.31°C with a mean value of 2.43°C.

Outside Basin has no Major/Medium storage projects and 146 Minor existing projects with cumulative live storage capacity of 37.74 Mm^3. The approximate water storage capacity of 1667 WHSs in basin is 120.96 Mm^3. The salient features of existing projects are given in Appendix 4. In addition to this, Outside basin gets imported surface water through Bhakra Canal, Gang Canal, Nohar Sidhmukh Canal and Indira Gandhi Nahar Project, details of which are given in Chapter 12.

6. Administrative Setup

There are 33 districts and 249 Blocks in Rajasthan. The Blocks falling under each district with their areas are given in Table 6.1.

Table 6.1: Districts and Blocks of Rajasthan

S. No.	District	S. No.	Block	Area, km^2
1	Ajmer	1	Arain	1,197.08
		2	Bhinay	1,221.57
		3	Jawaja	696.76
		4	Kekri	988.91
		5	Kishangarh	1,182.97
		6	Masuda	862.89
		7	Peesangan	1,398.22
		8	Srinagar	934.03
	Ajmer Total			8,482.43
2	Alwar	1	Bansur	682.18
		2	Behror	352.10
		3	Kathumar	573.87
		4	Kishangarh Bas	526.75
		5	Kotkasim	353.12
		6	Lachhmangarh	605.11
		7	Mandawar	573.64
		8	Neemrana	388.00
		9	Rajgarh	768.03
		10	Ramgarh	613.15
		11	Reni	390.56
		12	Thanagazi	836.99
		13	Tijara	687.79
		14	Umren	1,037.95
	Alwar Total			8,389.24
3	Banswara	1	Anandpuri	345.09
		2	Bagidora	509.76
		3	Banswara	744.09
		4	Chhoti Sarwan	374.00
		5	Garhi	678.62
		6	Ghatol	808.74
		7	Kushalgarh	646.92
		8	Sajjangarh	376.76
	Banswara Total			4,483.99
4	Baran	1	Antah	990.22
		2	Atru	859.82
		3	Baran	621.48
		4	Chhabra	800.33
		5	Chhipabarod	829.13
		6	Kishanganj	1,442.97

S. No.	District	S. No.	Block	Area, km²
		7	Shahbad	1,465.28
	Baran Total			7,009.23
5	Barmer	1	Balotra	3,462.01
		2	Barmer	3,880.31
		3	Baytoo	3,443.75
		4	Chohtan	3,295.78
		5	Dhorimanna	2,691.95
		6	Sheo	6,611.57
		7	Sindhari	2,978.75
		8	Siwana	2,076.55
	Barmer Total			28,440.67
6	Bharatpur	1	Bayana	792.33
		2	Deeg	496.69
		3	Kaman	574.26
		4	Kumher	441.43
		5	Nadbai	443.16
		6	Pahari	656.18
		7	Rupbas	563.93
		8	Sewar	505.21
		9	Weir	610.60
	Bharatpur Total			5,083.78
7	Bhilwara	1	Asind	1,135.37
		2	Banera	673.81
		3	Hurda	605.54
		4	Jahazpur	1,075.25
		5	Kotri	940.41
		6	Mandal	1,211.67
		7	Mandalgarh	1,558.61
		8	Raipur	521.31
		9	Sahara	667.88
		10	Shahpura	1,131.88
		11	Suwana	925.22
	Bhilwara Total			10,446.96
8	Bikaner	1	Bikaner	3,725.06
		2	Dungargarh	2,988.64
		3	Khajuwala	5,446.92
		4	Kolayat	7,948.76
		5	Lunkaransar	6,366.05
		6	Nokha	3,789.16
	Bikaner Total			30,264.60
9	Bundi	1	Bundi	967.34
		2	Hindoli	1,329.62
		3	Keshoraipatan	1,357.15
		4	Nainwa	1,205.31
		5	Talera	919.30

S. No.	District	S. No.	Block	Area, km²
	Bundi Total			5,778.71
10	Chittaurgarh	1	Bari Sadri	505.43
		2	Begun	972.18
		3	Bhadesar	530.30
		4	Bhainsrorgarh	1,572.14
		5	Bhopalsagar	410.01
		6	Chittaurgarh	965.17
		7	Dungla	500.27
		8	Gangrar	573.50
		9	Kapasan	492.36
		10	Nimbahera	855.20
		11	Rashmi	459.39
	Chittaurgarh Total			7,835.96
11	Churu	1	Churu	1,590.37
		2	Rajgarh	2,199.58
		3	Ratangarh	1,691.90
		4	Sardarshahar	3,839.56
		5	Sujangarh	2,694.59
		6	Taranagar	1,824.78
	Churu Total			13,840.78
12	Dausa	1	Bandikui	643.23
		2	Dausa	917.65
		3	Lalsot	855.92
		4	Mahwa	498.81
		5	Sikrai	510.61
	Dausa Total			3,426.22
13	Dhaulpur	1	Bari	809.90
		2	Baseri	1,001.95
		3	Dhaulpur	625.35
		4	Rajakhera	607.61
	Dhaulpur Total			3,044.81
14	Dungarpur	1	Aspur	692.65
		2	Bichhiwara	976.17
		3	Dungarpur	566.11
		4	Sagwara	705.57
		5	Simalwara	832.01
	Dungarpur Total			3,772.51
15	Ganganagar	1	Anupgarh	1,537.64
		2	Ganganagar	852.89
		3	Gharsana	1,971.44
		4	Karanpur	833.19
		5	Padampur	861.66
		6	Raisinghnagar	1,326.07
		7	Sadulshahar	896.13
		8	Suratgarh	2,424.21

S. No.	District	S. No.	Block	Area, km²
	Ganganagar Total			10,703.23
16	Hanumangarh	1	Bhadra	1,743.94
		2	Hanumangarh	1,360.97
		3	Nohar	2,375.67
		4	Pilibanga	1,238.24
		5	Rawatsar	1,885.97
		6	Sangaria	543.35
		7	Tibi	769.39
	Hanumangarh Total			9,917.54
17	Jaipur	1	Amber	895.99
		2	Bassi	634.54
		3	Chaksu	821.02
		4	Dudu	1,962.10
		5	Govindgarh	674.96
		6	Jamwa Ramgarh	1,022.07
		7	Jhotwara	557.67
		8	Kotputli	646.83
		9	Phagi	1,115.66
		10	Sambhar	936.40
		11	Sanganer	697.80
		12	Shahpura	478.87
		13	Viratnagar	695.73
	Jaipur Total			11,139.65
18	Jaisalmer	1	Jaisalmer	11,781.70
		2	Sam	21,304.38
		3	Sankra	5,425.09
	Jaisalmer Total			38,511.18
19	Jalore	1	Ahore	1,621.71
		2	Bhinmal	1,282.60
		3	Chitalwana	1,773.33
		4	Jalore	1,046.71
		5	Jaswantpura	1,155.92
		6	Raniwara	1,055.08
		7	Sanchore	1,212.47
		8	Sayla	1,474.10
	Jalore Total			10,621.92
20	Jhalawar	1	Bakani	897.83
		2	Dag	1,145.60
		3	Jhalrapatan	1,322.49
		4	Khanpur	939.44
		5	Manohar Thana	978.63
		6	Pirawa	1,033.80
	Jhalawar Total			6,317.79
21	Jhunjhunun	1	Alsisar	821.89
		2	Buhana	653.67

S. No.	District	S. No.	Block	Area, km²
		3	Chirawa	486.73
		4	Jhunjhunun	803.62
		5	Khetri	799.74
		6	Nawalgarh	682.61
		7	Surajgarh	814.89
		8	Udaipurwati	853.92
	Jhunjhunun Total			5,917.08
22	Jodhpur	1	Balesar	1,842.93
		2	Bap	4,386.96
		3	Bawari	1,399.19
		4	Bhopalgarh	1,883.91
		5	Bilara	1,569.88
		6	Luni	2,000.48
		7	Mandor	1,539.60
		8	Osian	2,810.32
		9	Phalodi	3,239.61
		10	Shergarh	1,994.63
	Jodhpur Total			22,667.50
23	Karauli	1	Hindaun	640.04
		2	Karauli	1,233.83
		3	Nadoti	615.40
		4	Sapotra	1,957.84
		5	Todabhim	543.28
	Karauli Total			4,990.38
24	Kota	1	Itawa	898.83
		2	Khairabad	762.94
		3	Ladpura	1,474.75
		4	Sangod	1,080.48
		5	Sultanpura	910.28
	Kota Total			5,127.27
25	Nagaur	1	Degana	1,509.47
		2	Didwana	1,655.25
		3	Jayal	2,076.16
		4	Kuchaman City	1,638.78
		5	Ladnu	1,267.07
		6	Makrana	1,138.35
		7	Merta	1,504.52
		8	Mundwa	2,295.70
		9	Nagaur	2,418.30
		10	Parbatsar	1,101.19
		11	Riyan	1,190.93
	Nagaur Total			17,795.72
26	Pali	1	Bali	1,363.81
		2	Desuri	827.98
		3	Jaitaran	1,350.61

S. No.	District	S. No.	Block	Area, km²
		4	Marwar Junction	1,428.24
		5	Pali	1,364.95
		6	Raipur	1,114.19
		7	Rani	831.78
		8	Rohat	1,421.04
		9	Sojat	1,680.82
		10	Sumerpur	984.35
	Pali Total			12,367.77
27	Pratapgarh	1	Arnod	708.24
		2	Chhoti Sadri	707.50
		3	Dhariawad	922.84
		4	Peepalkhoont	543.56
		5	Pratapgarh	1,556.58
	Pratapgarh Total			4,438.71
28	Rajsamand	1	Amet	488.77
		2	Bhim	696.79
		3	Deogarh	586.49
		4	Khamnor	763.29
		5	Kumbhalgarh	897.37
		6	Railmagra	562.51
		7	Rajsamand	626.96
	Rajsamand Total			4,622.18
29	Sawai Madhopur	1	Bamanwas	770.22
		2	Bonli	1,008.99
		3	Gangapur	645.58
		4	Khandar	1,365.06
		5	Sawai Madhopur	1,266.02
	Sawai Madhopur Total			5,055.87
30	Sikar	1	Danta Ramgarh	1,206.99
		2	Dhond	932.04
		3	Fatehpur	1,241.76
		4	Khandela	782.52
		5	Lachhmangarh	1,045.82
		6	Neem Ka Thana	1,189.26
		7	Piprali	746.94
		8	Sri Madhopur	582.08
	Sikar Total			7,727.41
31	Sirohi	1	Abu Road	882.93
		2	Pindwara	1,107.22
		3	Reodar	1,053.81
		4	Sheoganj	909.88
		5	Sirohi	1,173.22
	Sirohi Total			5,127.07
32	Tonk	1	Deoli	1,228.20
		2	Malpura	1,493.28

S. No.	District	S. No.	Block	Area, km²
		3	Niwai	988.07
		4	Todaraisingh	976.39
		5	Tonk	1,521.86
		6	Uniara	984.77
	Tonk Total			7,192.56
33	Udaipur	1	Bargaon	461.64
		2	Bhindar	1,109.43
		3	Girwa	1,393.51
		4	Gogunda	1,049.96
		5	Jhadol	1,388.56
		6	Kherwara	628.02
		7	Kotra	1,757.28
		8	Lasadiya	511.86
		9	Mavli	797.48
		10	Rishabhdeo	511.44
		11	Salumbar	1,034.66
		12	Sarada	1,079.23
	Udaipur Total			11,723.08
	State Total			342,263.80

Table 6.2 shows the districts falling under various riverbasins of Rajasthan.

Table 6.2: Districts Falling Under Various River Basins of Rajasthan

Basin	District	District Area Inside Basin, km²	Total District Area, km²	Percentage of District Area falling Inside Basin, %	District Area as Percentage of Basin Area, %
Shekhawati	Ajmer	989.63	8,482.43	11.67	10.15
	Alwar	539.53	8,389.24	6.43	5.53
	Churu	10.25	13,840.78	0.07	0.11
	Jaipur	1,997.04	11,139.65	17.93	20.48
	Jhunjhunu	1,773.45	5,917.08	29.97	18.19
	Nagaur	1,459.68	17,795.72	8.20	14.97
	Sikar	2,981.30	7,727.41	38.58	30.57
Shekhawati Total		**9,750.88**			**100.00**
Ruparail	Alwar	2,705.41	8,389.24	32.25	67.07
	Bharatpur	1,328.26	5,083.78	26.13	32.93
Ruparail Total		**4,033.66**			**100.00**
Banganga	Alwar	2,334.59	8,389.24	27.83	27.20
	Bharatpur	2,530.47	5,083.78	49.78	29.48
	Dausa	2,144.55	3,426.22	62.59	24.99
	Jaipur	1,322.77	11,139.65	11.87	15.41
	Karauli	244.84	4,990.38	4.91	2.85
	Sawai Madhopur	5.31	5,055.87	0.11	0.06
	Sikar	0.81	7,727.41	0.01	0.01
Banganga Total		**8,583.34**			**100.00**
Gambhir	Bharatpur	1,217.93	5,083.78	23.96	25.95
	Dausa	101.66	3,426.22	2.97	2.17

Basin	District	District Area Inside Basin, km²	Total District Area, km²	Percentage of District Area falling Inside Basin, %	District Area as Percentage of Basin Area, %
	Dhaulpur	722.88	3,044.81	23.74	15.40
	Karauli	2,422.44	4,990.38	48.54	51.61
	Sawai Madhopur	228.61	5,055.87	4.52	4.87
Gambhir Total		**4,693.52**			**100.00**
Parbati	Bharatpur	7.12	5,083.78	0.14	0.38
	Dhaulpur	1,489.72	3,044.81	48.93	78.94
	Karauli	390.23	4,990.38	7.82	20.68
Parbati Total		**1,887.07**			**100.00**
Sabi	Alwar	2,809.72	8,389.24	33.49	62.11
	Jaipur	1,325.50	11,139.65	11.90	29.30
	Sikar	388.46	7,727.41	5.03	8.59
Sabi Total		**4,523.67**			**100.00**
Banas	Ajmer	5,552.85	8,482.43	65.46	11.80
	Bhilwara	9,396.59	10,446.96	89.95	19.97
	Bundi	167.79	5,778.71	2.90	0.36
	Chittaurgarh	5,459.81	7,835.96	69.68	11.60
	Dausa	1,180.01	3,426.22	34.44	2.51
	Jaipur	6,494.35	11,139.65	58.30	13.80
	Karauli	1,113.98	4,990.38	22.32	2.37
	Pratapgarh	172.34	4,438.71	3.88	0.37
	Rajsamand	4,217.10	4,622.18	91.24	8.96
	Sawai Madhopur	3,859.13	5,055.87	76.33	8.20
	Tonk	6,762.21	7,192.56	94.02	14.37
	Udaipur	2,684.11	11,723.08	22.90	5.70
Banas Total		**47,060.27**			**100.00**
Chambal	Baran	7,009.23	7,009.23	100.00	22.43
	Bhilwara	1,047.38	10,446.96	10.03	3.35
	Bundi	5,610.92	5,778.71	97.10	17.96
	Chittaurgarh	2,189.91	7,835.96	27.95	7.01
	Dhaulpur	832.22	3,044.81	27.33	2.66
	Jhalawar	6,317.79	6,317.79	100.00	20.22
	Karauli	818.89	4,990.38	16.41	2.62
	Kota	5,127.27	5,127.27	100.00	16.41
	Pratapgarh	895.73	4,438.71	20.18	2.87
Chambal	Sawai Madhopur	962.82	5,055.87	19.04	3.08
	Tonk	430.35	7,192.56	5.98	1.38
Chambal Total		**31,242.50**			**100.00**
Mahi	Banswara	4,483.99	4,483.99	100.00	26.99
	Chittaurgarh	186.24	7,835.96	2.38	1.12
	Dungarpur	3,160.94	3,772.51	83.79	19.03
	Pratapgarh	3,370.64	4,438.71	75.94	20.29
	Udaipur	5,408.82	11,723.08	46.14	32.56
Mahi Total		**16,610.63**			**100.00**
Sabarmati	Dungarpur	611.57	3,772.51	16.21	14.81
	Pali	1.40	12,367.77	0.01	0.03
	Sirohi	69.59	5,127.07	1.36	1.68
	Udaipur	3,447.56	11,723.08	29.41	83.47
Sabarmati Total		**4,130.12**			**100.00**
Luni	Ajmer	1,939.96	8,482.43	22.87	2.80

Basin	District	District Area Inside Basin, km²	Total District Area, km²	Percentage of District Area falling Inside Basin, %	District Area as Percentage of Basin Area, %
	Barmer	21,535.07	28,440.67	75.72	31.07
	Bhilwara	2.99	10,446.96	0.03	0.00
	Jaisalmer	1,947.35	38,511.18	5.06	2.81
	Jalore	8,887.24	10,621.92	83.67	12.82
	Jodhpur	13,685.88	22,667.50	60.38	19.75
	Nagaur	6,279.48	17,795.72	35.29	9.06
	Pali	12,363.53	12,367.77	99.97	17.84
	Rajsamand	405.07	4,622.18	8.76	0.58
	Sirohi	2,076.07	5,127.07	40.49	3.00
	Udaipur	179.47	11,723.08	1.53	0.26
Luni Total		**69,302.11**			**100.00**
West Banas	Pali	2.85	12,367.77	0.02	0.16
	Sirohi	1,825.39	5,127.07	35.60	99.67
	Udaipur	3.11	11,723.08	0.03	0.17
West Banas Total		**1,831.34**			**100.00**
Sukli	Sirohi	990.44	5,127.07	19.32	100.00
Sukli Total		**990.44**			**100.00**
Other Nallahs of Jalore	Jalore	1,734.67	10,621.92	16.33	91.29
	Sirohi	165.59	5,127.07	3.23	8.71
Other Nallahs of Jalore Total		**1,900.27**			**100.00**
Ghaggar	Ganganagar	3,153.07	10,703.23	29.46	60.62
	Hanumangarh	2,048.43	9,917.54	20.65	39.38
Ghaggar Total		**5,201.51**			**100.00**
Outside Basin	Barmer	6,905.60	28,440.67	24.28	5.29
	Bikaner	30,264.60	30,264.60	100.00	23.19
	Churu	13,830.53	13,840.78	99.93	10.60
	Ganganagar	7,550.15	10,703.23	70.54	5.78
	Hanumangarh	7,869.11	9,917.54	79.35	6.03
	Jaisalmer	36,563.83	38,511.18	94.94	28.01
	Jhunjhunu	4,143.63	5,917.08	70.03	3.17
	Jodhpur	8,981.62	22,667.50	39.62	6.88
	Nagaur	10,056.56	17,795.72	56.51	7.70
	Sikar	4,356.84	7,727.41	56.38	3.34
Outside Basin Total		**130,522.48**			**100.00**
State Total		**342,263.80**			

Note: As per Final Report No. 4.2.

7. Landuse and Soils

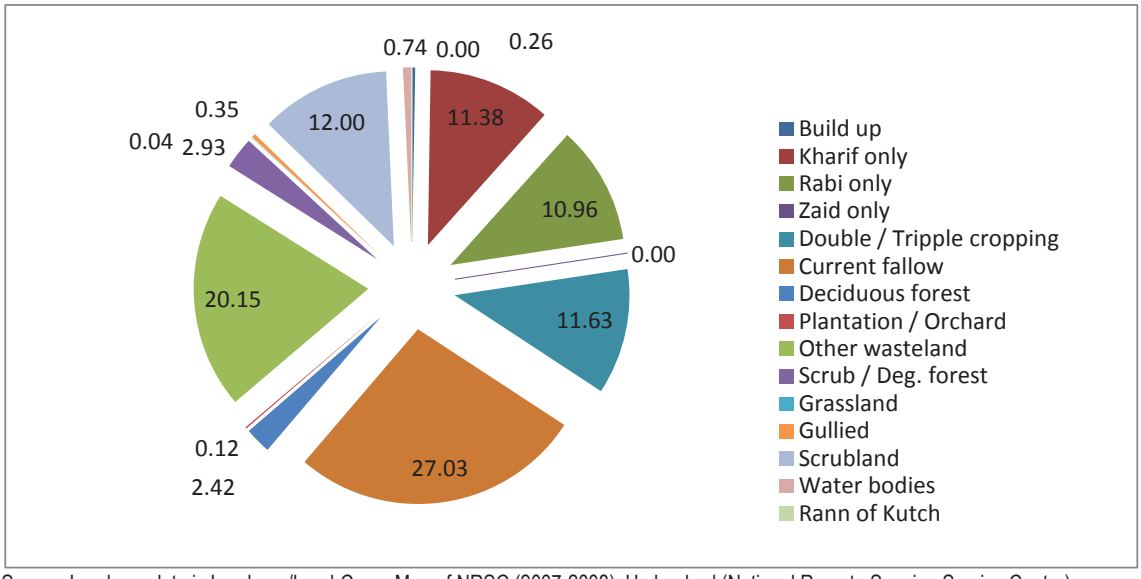
Land Use is another important segment of data required for planning purposes. The land use map from National Remote Sensing Centre (NRSC), Hyderabad (2007-2008) has been used for the present study. Different categories of landuse and their areas in Rajasthan State, River basins of Rajasthan and Districts of Rajasthan are shown in Table 7.1, Table 7.2 and Table 7.3, respectively. Graphical representation of State landuse percentages is shown in Figure 7.1.

Table 7.1: Land Uses as Percentage of State Area

Landuse	Area, km²	Landuse, %
Build up	887.38	0.26
Kharif only	38,938.06	11.38
Rabi only	37,526.85	10.96
Zaid only	0.51	0.00
Double / Tripple cropping	39,799.98	11.63
Current fallow	92,497.03	27.03
Deciduous forest	8,291.51	2.42
Plantation / Orchard	411.27	0.12
Other wasteland	68,953.64	20.15
Scrub / Deg. forest	10,026.94	2.93
Grassland	123.80	0.04
Gullied	1,207.39	0.35
Scrubland	41,062.01	12.00
Water bodies	2,527.80	0.74
Rann of Kutch	0.29	0.00
Total	342,263.80	

Source: National Remote Sensing Centre (NRSC), Hyderabad (2007-2008)

Figure 7.1: Graphical Representation of State Landuse Percentages



Source: Land use data is Land-use/Land-Cover Map of NRSC (2007-2008), Hyderabad (National Remote Sensing Service Centre)

Table 7.2: Categories of Landuse and their Areas in River Basins of Rajasthan

Landuse Categories	Area in River Basins (km^2)															
	Shekhawati	Ruparail	Banganga	Gambhir	Parbati	Sabi	Banas	Chambal	Mahi	Sabarmati	Luni	West Banas	Sukli	Other Nallahs	Ghaggar	Outside
Build up	6.53	66.48	13.06	-	-	0.40	243.45	91.20	12.95	-	176.93	-	-	-	21.66	254.72
Kharif only	1,007.18	143.55	363.29	133.72	66.10	263.01	6,049.91	2,509.36	2,199.41	581.59	7,438.15	179.26	87.14	366.78	160.07	17,389.54
Rabi only	1,333.59	1,742.07	4,250.72	1,870.92	473.36	1,285.70	8,159.44	4,813.21	1,600.35	50.18	5,364.15	202.66	144.42	278.65	880.58	5,076.85
Zaid only	0.01	0.43	-	-	-	0.06	-	-	-	-	-	-	-	-	-	0.01
Double / Tripple cropping	2,614.67	672.93	377.41	180.54	68.62	1,513.51	5,513.21	6,590.83	2,110.45	509.75	4,632.32	291.32	361.95	333.57	2,475.61	11,553.29
Current fallow	2,740.25	359.17	2,022.47	1,400.43	374.78	543.85	19,249.47	4,629.02	3,999.93	156.07	30,104.58	201.43	120.80	590.69	743.98	25,260.11
Deciduous forest	85.01	1.09	393.44	81.35	64.85	142.13	806.30	2,174.14	1,816.21	1,736.29	518.26	307.99	103.79	7.30	8.28	45.08
Plantation / Orchard	0.10	410.89	-	-	-	0.28	-	-	-	-	-	-	-	-	-	-
Other wasteland	1,189.65	396.54	502.06	451.29	426.56	312.73	4,041.57	5,581.95	2,343.04	477.88	13,982.04	443.71	98.44	271.27	551.73	37,883.18
Scrub / Deg. forest	442.86	154.50	423.64	293.94	235.91	371.39	1,147.33	3,001.32	2,067.22	580.64	983.49	182.07	36.91	11.70	5.49	88.53
Grassland	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	123.80
Gullied	15.90	62.44	110.57	93.51	30.94	57.53	36.72	793.21	0.12	-	6.04	-	-	-	-	0.41
Scrubland	238.30	14.82	115.00	169.83	136.75	29.06	1,271.83	418.69	111.99	22.43	5,933.79	20.82	36.76	37.80	248.64	32,255.50
Water bodies	76.82	8.74	11.70	17.98	9.20	4.02	531.70	639.56	348.97	15.29	162.07	2.08	0.23	2.51	105.47	591.46
Rann of Kutch	-	-	-	-	-	-	-	-	-	-	0.29	-	-	-	-	-
Total	9,750.88	4,033.65	8,583.34	4,693.52	1,887.07	4,523.67	47,060.27	31,242.50	16,610.63	4,130.12	69,302.11	1,831.34	990.44	1,900.27	5,201.51	130,522.48

Source: National Remote Sensing Centre (NRSC), Hyderabad (2007-2008)

Table 7.3: Categories of Landuse and their Areas in Districts of Rajasthan

Landuse Categories	Area in Districts (km^2)																	
	Ajmer	Alwar	Banswara	Baran	Barmer	Bharatpur	Bhilwara	Bikaner	Bundi	Chittaurgarh	Churu	Dausa	Dhaulpur	Dungarpur	Ganganagar	Hanumangarh	Jaipur
Build up	34.34	48.75	3.50	20.46	68.46	25.74	51.68	59.06	17.25	34.78	27.00	9.37	2.43	2.46	27.86	23.89	37.06
Kharif only	1,024.36	414.28	593.71	562.96	3,231.44	189.29	1,292.47	4,032.14	472.27	902.45	1,843.70	245.38	139.62	504.70	1,102.91	1,111.40	1,174.16
Rabi only	1,248.36	3,197.32	432.00	1,079.82	1,935.50	2,313.69	1,790.82	1,177.18	893.57	1,301.99	539.33	1,307.43	790.12	311.97	827.50	652.82	2,430.85
Zaid only	-	0.33	-	-	-	0.14	-	-	-	-	-	-	-	-	-	-	0.02
Double / Tripple cropping	1,045.69	1,639.10	569.70	1,478.62	2,050.75	379.92	1,321.96	2,678.88	1,203.38	1,125.29	1,226.92	236.47	257.51	477.13	2,169.07	1,671.34	1,797.82
Current fallow	3,392.36	1,280.68	1,079.75	1,038.50	10,691.37	1,079.13	4,000.19	5,857.09	900.08	2,602.64	2,679.48	1,018.48	634.91	784.29	1,912.15	1,815.82	3,688.54
Deciduous forest	118.28	200.76	490.27	487.76	163.43	137.67	233.89	10.45	393.35	266.29	4.86	120.30	121.64	602.84	7.63	5.98	230.95
Plantation / Orchard	0.01	275.77	-	-	-	135.30	-	-	-	-	-	-	-	-	-	-	0.10
Other wasteland	989.09	662.71	632.48	1,252.28	6,349.24	397.23	994.70	8,784.02	1,016.93	886.43	4,015.49	236.60	554.98	516.67	2,525.76	2,501.13	970.35
Scrub / Deg. forest	207.88	474.12	558.03	673.33	310.30	252.88	329.72	20.53	543.13	366.65	9.84	141.02	311.48	479.40	8.45	7.50	423.11
Grassland	-	-	-	-	6.55	-	-	28.71	-	-	13.12	-	-	-	7.16	7.46	-
Gullied	6.12	108.58	0.03	177.95	1.90	77.53	33.92	0.10	142.59	59.86	0.06	30.58	59.96	0.02	0.02	0.02	42.22
Scrubland	340.38	72.47	30.23	93.93	3,550.52	83.35	268.25	7,479.12	79.74	178.16	3,418.18	64.32	145.29	24.63	2,016.50	2,042.50	250.55
Water bodies	75.08	15.80	94.20	143.48	81.66	11.03	127.61	137.14	116.76	110.43	62.75	16.65	27.07	68.67	98.15	77.19	92.09
Rann of Kutch	-	-	-	-	0.08	-	-	-	-	-	-	-	-	-	-	-	-
Total	8,482.43	8,389.24	4,483.99	7,009.23	28,440.67	5,083.78	10,446.96	30,264.60	5,778.71	7,835.96	13,840.78	3,426.22	3,044.81	3,772.51	10,703.23	9,917.54	11,139.65

Source: National Remote Sensing Centre (NRSC), Hyderabad (2007-2008)

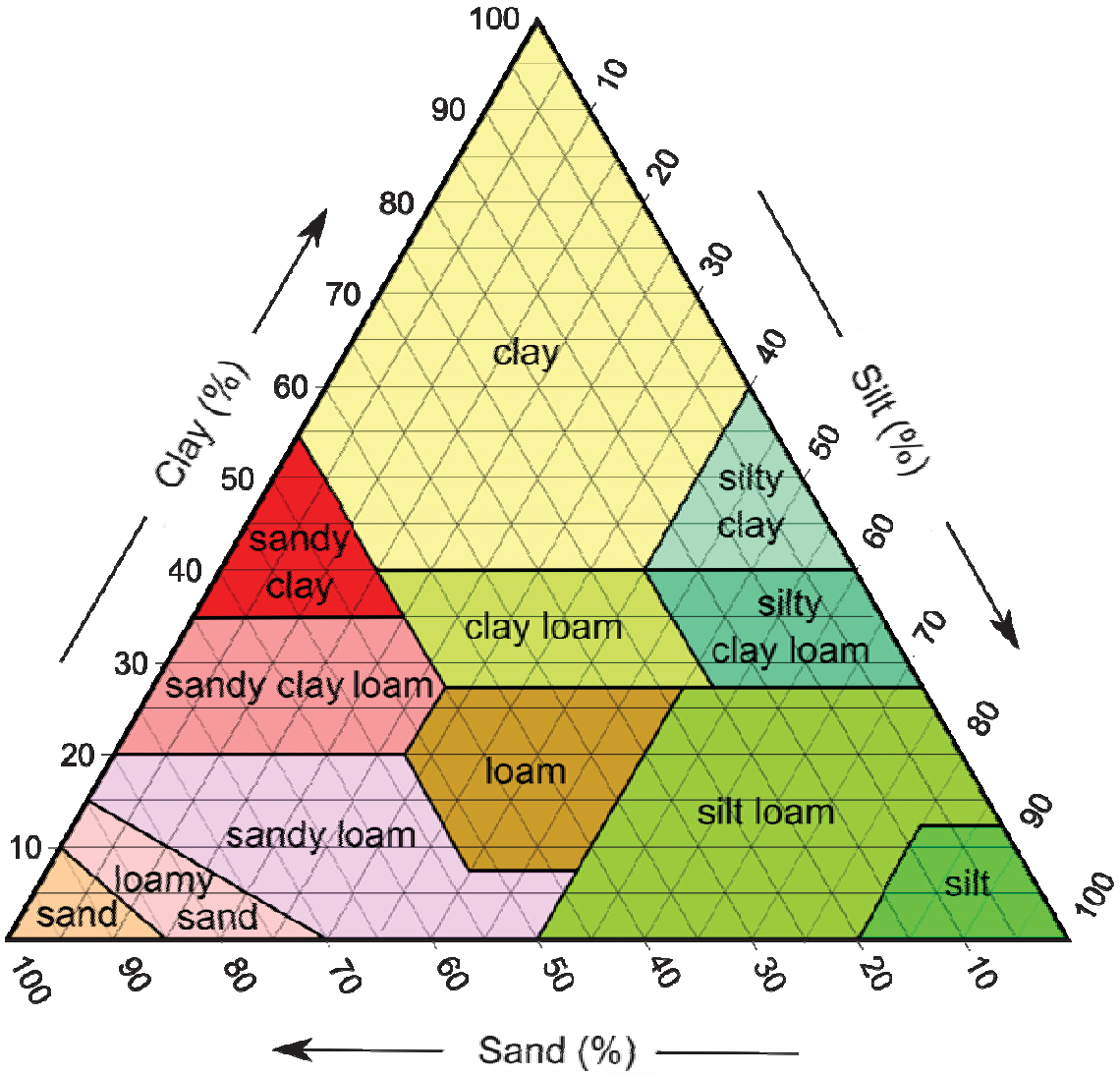
Table 7.3: Categories of Landuse and their Areas in Districts of Rajasthan (contd.)

Landuse Categories	Area in Districts (km^2)															
	Jaisalmer	Jalore	Jhalawar	Jhunjhunun	Jodhpur	Karauli	Kota	Nagaur	Pali	Pratapgarh	Rajsamand	Sawai Madhopur	Sikar	Sirohi	Tonk	Udaipur
Build up	76.33	22.69	18.44	9.27	52.47	8.53	14.97	36.63	31.57	6.13	22.85	22.78	10.53	5.30	36.24	18.56
Kharif only	5,080.31	1,288.60	507.46	735.23	2,665.58	302.02	411.80	2,164.61	1,327.48	540.42	585.60	580.19	910.98	530.52	903.84	1,566.18
Rabi only	1,572.88	942.20	973.36	403.67	1,408.71	1,503.83	789.88	1,076.87	957.36	492.63	762.51	911.20	687.95	532.29	1,238.67	1,042.55
Zaid only	-	-	-	-	-	-	-	-	-	-	-	-	0.01	-	-	-
Double / Tripple cropping	3,366.57	898.48	1,332.85	842.22	1,709.85	421.39	1,081.59	1,701.39	827.05	637.46	521.10	664.28	1,314.87	828.85	882.90	1,439.57
Current fallow	7,921.90	4,399.65	936.12	1,300.23	7,683.50	1,434.79	759.65	5,084.21	5,371.33	1,014.85	1,900.86	1,790.67	1,727.81	1,277.62	2,829.65	2,608.71
Deciduous forest	27.19	73.12	439.67	16.89	105.45	142.69	356.79	63.16	93.39	433.88	75.28	137.33	39.73	456.35	145.78	2,088.46
Plantation / Orchard	-	-	-	0.02	-	-	-	0.01	-	-	-	-	0.05	-	-	-
Other wasteland	11,005.05	2,040.61	1,128.83	1,419.05	5,368.17	577.35	916.03	4,363.88	2,495.38	650.35	443.87	525.78	1,655.14	991.33	657.56	1,429.17
Scrub / Deg. forest	52.43	136.80	606.95	83.33	200.32	318.35	492.53	162.24	175.90	509.79	108.56	201.18	170.25	258.71	206.17	1,226.06
Grassland	34.68	-	-	3.93	8.52	-	-	9.54	-	-	-	-	4.13	-	-	-
Gullied	0.28	0.77	160.41	2.90	1.22	79.46	130.17	2.96	1.08	22.91	3.33	32.09	9.82	0.18	16.19	2.15
Scrubland	9,202.45	795.43	84.67	1,067.40	3,391.49	160.26	68.71	3,058.61	1,058.69	39.38	148.64	125.55	1,152.06	238.95	188.51	143.09
Water bodies	170.24	23.07	129.34	32.75	72.71	40.86	104.96	71.76	28.92	91.10	48.59	64.20	43.57	7.64	85.20	157.14
Rann of Kutch	-	0.21	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total	38,511.18	10,621.92	6,317.79	5,917.08	22,667.50	4,990.38	5,127.27	17,795.72	12,367.77	4,438.71	4,622.18	5,055.87	7,727.41	5,127.07	7,192.56	11,723.08

Source: National Remote Sensing Centre (NRSC), Hyderabad (2007-2008)

Information on the soil profile is also required for simulating the hydrological character of the basin. Soil map of Rajasthan from State Remote Sensing Application Centre (SRSAC), Department of Science and Technology (DST), Jodhpur has been used for the present study. In terms of soil texture, soil type[2] usually refers to the different sizes of mineral particles in a particular sample. Soil is made up in part of finely ground rock particles, grouped according to size as sand and silt in addition to clay, organic material such as decomposed plant matter. Each component, and their size, play an important role. For example, the largest particles, sand, determine aeration and drainage characteristics, while the tiniest, sub-microscopic clay particles, are chemically active, binding with water and plant nutrients. The ratio of these sizes determines soil type: clay, loam, clay-loam, silt-loam, and so on (see Figure 7.2). Different categories of soil type and their areas in basins of Rajasthan are shown in Table 7.4.

Figure 7.2: Soil types by clay, silt and sand composition



[2] http://soils.usda.gov/technical/aids/investigations/texture/

Sand, Silt and Clay percentage of all soil layers (Source: Soil Atlas of Rajasthan, SRSAC, Jodhpur) were available and these layers are then classified into appropriate soil texture class by the relative proportion of the three kinds of soil particles as shown in above Texture triangle.

The sides of the soil texture triangle are scaled for the percentages of sand, silt, and clay. Clay percentages are read from left to right across the triangle. Silt is read from the upper right to lower left. Sand from lower right towards the upper left portion of the triangle. The intersection of the three sizes on the triangle give the texture class. For instance, if you have a soil with 20% clay, 60% silt, and 20% sand it falls in the "silt loam" class.

Table 7.4: Categories of Soil Type and their Areas in River Basins of Rajasthan

Soil Type	Area (km^2)																
	Shekhawati	Ruparail	Banganga	Gambhir	Parbati	Sabi	Banas	Chambal	Mahi	Sabarmati	Luni	West Banas	Sukli	Other Nallahs	Ghaggar	Outside	State Total
Clay	2,224.67	1,939.76	1,359.62	725.64	205.18	2,755.85	7,584.22	8,030.38	1,902.25	176.98	1,265.48	2.94	11.47	-	-	125.12	28,309.56
Clay Loam	1,049.19	-	23.27	260.73	7.85	102.10	6,372.73	1,901.79	111.07	-	2,326.04	180.87	119.45	-	2,266.35	7,410.15	22,131.59
Loam	389.44	790.27	1,290.26	907.48	306.40	471.60	2,685.02	534.22	782.24	106.46	3,510.64	0.66	0.40	-	550.92	7,510.41	19,836.42
Loamy Sand	2,340.61	245.06	1492.60	195.43	56.33	402.77	7,333.16	8,169.52	1,471.45	108.05	30,779.79	911.43	531.11	243.15	2,306.60	1,08,239.70	56,587.06
Sand	538.36	551.69	851.36	618.88	867.56	169.62	6,455.29	4,326.26	4,567.66	2,543.20	2,859.43	150.94	61.98	12.64	-	-	24,574.87
Sandy Clay Loam	649.22	377.94	310.93	453.01	7.17	231.01	1,519.13	1,003.51	1,239.68	105.10	5,727.19	496.65	248.37	936.47	77.64	2.50	13,385.52
Sandy Loam	2,534.83	84.83	3255.30	1,463.66	436.58	218.38	13,943.90	5,989.75	6,448.03	1,043.77	14,842.10	87.63	16.33	706.57	-	3,277.46	54,349.12
Silt Loam	24.56	44.11	-	68.69	-	172.34	1,166.82	1,287.07	88.25	46.56	7,991.44	0.22	1.33	1.44	-	3,957.19	14,850.02
Total	9,750.88	4,033.65	8,583.34	4,693.52	1,887.07	4,523.67	47,060.27	31,242.50	16,610.63	4,130.12	69,302.11	1,831.34	990.44	1,900.27	5,201.51	130,522.48	342,263.80

Source: State Remote Sensing Application Centre (SRSAC), Department of Science and Technology (DST), Jodhpur

8. Population

8.1 Introduction

The Census of India 2011 reveals that since independence, Rajasthan has continued to maintain its record of registering one of the highest population growth rates in the country. Its reported annual growth rate of 2.13 percent is around 30 percent higher than that recorded for the country as a whole. It has doubled in a period of less than 29 years since 1951.

Rajasthan is divided into seven administrative divisions and 33 districts. The districts are further divided into 244 Tehsils and 249 Blocks. More than almost half of all the inhabited villages in the State, numbering 44,672, have fewer than 500 inhabitants each. About 25% of ~69 million population of the State resided in 297 towns in 2011.

8.2 Demographic Scenario

From a demographic perspective, Rajasthan is one of India's most critical states; it recorded the highest growth rate among the major states of India in the 1971-81 and 1981-91 decades. With a decadal growth rate of 28.3% during the nineties (1991-2001), the State ranked second after Bihar, which recorded the highest growth rate in the country - 28.4% while for decade 200-2011 its growth rate has decreased (21.3%) which is the 11th highest growth rate in the country. Table 8.1 presents some basic demographic information about India and Rajasthan.

Table 8.1: Socio-Demographic Profile, India and Rajasthan, 2011

		India		Rajasthan	
Population	Persons	1,210,569,573		68,548,437	
	Male	623,121,843		35,550,997	
	Female	586,447,730		32,997,440	
Decadal Population Growth 2001-2011		Absolute	Percentage	Absolute	Percentage
	Persons	181,959,458	17.69	12,041,249	21.31
	Male	90,935,182	17.09	6,130,986	20.84
	Female	90,994,276	18.33	5,910,263	21.82
Population Density, per km^2		382		200	
Sex Ratio (females per 1000 males)		943		928	
Population in the age group 0 – 6		Absolute	% of Total Population	Absolute	% of Total Population
	Persons	164,478,150	13.59	10,649,504	15.54
	Male	85,732,470	13.76	5,639,176	15.86
	Female	78,745,680	13.40	5,010,328	15.18
Literates		Absolute	Literacy rate	Absolute	Literacy rate
	Persons	763,498,517	72.99	38,275,282	66.11
	Male	434,683,779	80.89	23,688,412	79.19
	Female	328,814,738	64.64	14,586,870	52.12

Source: Census of India, 2011

To an estimated population of 56.5 million on March 1, 2001, the State has added more than 1.2 million people by the year 2010-11. Compare these figures to less than 0.4 million in the year 1956-57 when the present State of Rajasthan was a relatively recent phenomenon. After decades of very slow or minimal population growth, the State's population began to increase rapidly in the 1950s as a result of improvements in public health, which contributed to a steep decline in death rates without a corresponding decline in birth rates. The population grew from 10 million in 1901 to 16 million in 1951, but from 1951 to 2011 it grew about four and a quarter times to 68.5 million.

The most important reasons for the accelerating growth rate of population in Rajasthan are the nearly constant fertility and rapidly declining mortality.

8.3 Size, Growth Rate and Distribution of Population

Rajasthan is the largest state in area in India, with 342,264 km^2. According to the Census 2011, Rajasthan has registered a population of 68,548,437 by adding 12,041,249 persons to the total population of 56,507,188 in Census 2001. The decadal growth rate of the State has significantly declined from 28.41% in 1991-2001 to 21.31% in 2001-2011, registering a net decrease of 7.10%. All the districts of the State show a declining trend in the growth rate during the last decade.

8.4 Decadal Variation in Rajasthan Population Since 1901

The population of the State has increased more than six fold from 1901 to 2011. It was 10,294,090 in 1901 and increased to 68,548,437 in 2011, adding 58,254,347 persons. The State witnessed a sharp decline in population, of 690,861, during the decade 1911-1921 due to epidemics and famine, which took a heavy toll on life. Since then, a fluctuating trend is seen in the growth rate of State population. It increased up to 1941 and dipped up to1951 because of the partition of the country. Again, the growth rate of the population showed an increasing trend up to 1981, reaching ~33%. The growth rates reached a plateau during 1981-1991 and 1991-2001 at 28.44 to 28.41%. The 2011 Census brings the news of sharp decline in growth rate after two decades, from 28.44 to 21.31%, as shown in Table 8.2. It is also to be noted that this trend is prevalent across all districts.

Table 8.2: Percentage Decadal Variation in Rajasthan Population 1901-2011

Year	Population	Decadal Variation	Percentage Decadal Growth
1901	10,294,090	-	-
1911	10,983,509	+689,419	+6.70
1921	10,292,648	-690,861	-6.29
1931	11,747,974	+1,455,326	+14.14
1941	13,863,859	+2,115,885	+18.01
1951	15,970,774	+2,106,915	+15.20
1961	20,155,602	+4,184,828	+26.20
1971	25,765,806	+5,610,204	+27.83
1981	34,261,862	+8,496,056	+32.97
1991	4,4005,990	+9,744,128	+28.44

Year	Population	Decadal Variation	Percentage Decadal Growth
2001	56,507,188	+12,501,198	+28.41
2011	68,548,437	+12,041,249	+21.31

Source: Census of India, 2011

8.5 Population Density

One of the important indices of a nation's demography is the density of population. It is expressed as the number of persons per square kilometre. As the area of the State is static, with the increase of population the population density is bound to increase. In the last decade, the population density of Rajasthan has increased from 165 to 200 persons per km^2 (see Table 8.3).

Table 8.3: Population Density in Rajasthan, 1901-2011

Census Year	Density, Persons per km^2
1901	30
1911	32
1921	30
1931	34
1941	41
1951	47
1961	59
1971	75
1981	100
1991	129
2001	165
2011	200

Source: Census of India 2011

The population density of the State has increased more than six times during the last 100 years. During the years 1911-1921 the density decreased from 32 to 30 but has registered an increasing trend thereafter. This trend is a matter of concern, as high population density puts increasing pressure on the State's scarce natural resources and also adversely affects the quality of life.

8.6 Urbanization

Urbanization is a process of great demographic significance. It transfers population to a very different physical, social and economic environment. The urban population of Rajasthan was 13.2 million in 2001 which has increased to 17.0 million in 2011. The proportion of urban population to total population in Rajasthan is relatively low, only 23.4% according to Census 2001 and 24.9% according to census 2011. It is also increasing at a slow pace (see Table 8.4). In 2001, more than 57% of the urban population of Rajasthan lived in 20 Class I cities, with a population of 100,000 and more which has increased to 61% in 2011 (in 29 Class I cities). The proportion of urban population living in towns with a population of 20,000 or less has been declining. Around 18% of the State's urban population was enumerated in Jaipur, the capital city of the State.

Table 8.4: Annual Growth Rates

Year	Urban Population, in millions	% of total population
1951	2.59	16.22
1961	3.28	16.28
1971	4.54	17.62
1981	7.21	21.04
1991	10.06	22.95
2001	13.21	23.39
2011	17.05	24.87

Source: Census of India, 2001 and 2011

8.7 District wise and Basin wise Present Population

The data of rural and urban population upto Tehsil level as per Census 2011 was collected and considered as present population representing year 2010. The Tehsil level data was converted to Block level considering the percentage of the areas of different Tehsil falling in each Block which gave Block level/District level population and similarly gave Basin/Sub-basin level population. Accordingly, the Sub-basin wise and Basin wise and District wise present population is given in Table 8.5, Table 8.6 and Table 8.7, respectively.

8.8 Population Projections

8.8.1 General

The demographic scenario of a region depends upon a number of inter-dependent man-made and natural factors or causes, such as the geography of the region, available resources, social structure of the community, economic development, education level, birth and mortality rates, etc. Beside these factors, natural and man-made disasters also shape the demographic pattern. Naturally, the effect of all these complex factors cannot be compressed in few mathematical formulae and anticipations. Population projections give a broad perspective of the population data in the coming decades and may be used for macro planning of water resources for optimal results. The projections need to be validated based on the population data collected subsequently and advances in the methodologies used to compute the data. The population projections have been presented in detail in Final Report No. 4.6.

8.8.2 Methodology

The methodology adopted for population projections has been considered viable by the consultant as that being adopted by the Statistical Department of Govt. of Rajasthan in population projections. The ratio method has been found suitable by the Govt. of Rajasthan for population projections. The ratio method is described as below.

a. Firstly, the State total population has been projected by fitting a multinomial curve to the Census population of 1961, 1971, 1981, 1991, 2001 and 2011. State rural total population has also been projected similarly by fitting

multinomial curve of suitable degree. State urban total population projection has been obtained by subtraction of State total population by State rural population.

b. The district-wise population projections have been done by ratio method which is considered as the satisfactory procedure for projecting the population of sub-divisions of a country or state where its population has been projected by some other method. It has been anticipated that the population growth rate would gradually diminish to zero by year 2060, as targeted by the National Population Policy 2000 (NPP). But as per Consultant's projections, the growth rate would diminish to zero by the year 2070.

The growth rates were calculated for projected urban and rural population from 2010-2020, 2020-2040 and 2040-2060, which were applied to cities/towns and rural population to arrive at population for year 2020, 2040 and 2060. The Block level data was converted to Basin/Sub-basin level considering the percentage of the areas of different Block falling in each Basin/Sub-basin. Accordingly, Sub-basin wise and Basin wise present (2010) and projected population is given in Table 8.5 and Table 8.6, respectively. Also District-wise present (2010) and projected population is given in Table 8.7.

Table 8.5: Sub-Basin-wise Present (2010) and Projected Population

River Basin	Sub Basin	Type	2010	2020	2040	2060
Shekhawati	Dohan	Rural	626,067	701,074	824,747	905,084
		Urban	93,808	115,444	156,523	185,924
		Total	719,875	816,518	981,270	1,091,008
	Kantli	Rural	579,623	634,269	722,558	783,969
		Urban	79,521	98,690	133,980	158,285
		Total	659,144	732,959	856,538	942,254
	Mendha	Rural	1,551,861	1,780,194	2,160,651	2,396,023
		Urban	341,070	427,237	588,931	697,597
		Total	1,892,931	2,207,431	2,749,582	3,093,620
	Basin Total	Rural	2,757,551	3,115,537	3,707,955	4,085,076
		Urban	514,399	641,371	879,434	1,041,806
		Total	3,271,950	3,756,908	4,587,389	5,126,882
Ruparail	Basin Total	Rural	1,510,141	1,774,242	2,222,546	2,491,313
		Urban	483,479	631,521	921,388	1,123,538
		Total	1,993,620	2,405,763	3,143,934	3,614,851
Banganga	Basin Total	Rural	3,328,009	3,932,241	4,963,187	5,577,816
		Urban	603,685	723,692	962,311	1,153,883
		Total	3,931,694	4,655,933	5,925,498	6,731,699
Gambhir	Basin Total	Rural	1,586,225	1,871,005	2,355,855	2,645,326
		Urban	266,446	314,184	409,162	488,507
		Total	1,852,671	2,185,189	2,765,017	3,133,833
Parbati	Basin Total	Rural	503,064	589,377	735,340	823,074
		Urban	80,709	103,793	148,671	179,849
		Total	583,773	693,170	884,011	1,002,923
Sabi	Basin Total	Rural	1,719,413	1,996,712	2,462,399	2,745,322
		Urban	318,782	419,331	613,521	743,131
		Total	2,038,195	2,416,043	3,075,920	3,488,453
Banas	Banas	Rural	2,129,946	2,445,996	2,972,967	3,298,415

River Basin	Sub Basin	Type	2010	2020	2040	2060
		Urban	562,212	676,021	892,306	1,055,529
		Total	2,692,158	3,122,017	3,865,273	4,353,944
	Berach	Rural	1,693,604	1,961,607	2,412,897	2,688,438
		Urban	765,163	895,067	1,148,018	1,354,440
		Total	2,458,767	2,856,674	3,560,915	4,042,878
	Dain	Rural	505,115	587,729	726,618	810,777
		Urban	71,176	81,196	99,122	112,545
		Total	576,291	668,925	825,740	923,322
	Gudia	Rural	187,631	215,393	261,558	290,066
		Urban	37,765	44,528	57,267	66,975
		Total	225,396	259,921	318,825	357,041
	Kalisil	Rural	99,491	116,923	146,489	164,202
		Urban	6,716	7,858	10,158	12,151
		Total	106,207	124,781	156,647	176,353
	Khari	Rural	1,187,723	1,379,213	1,700,913	1,896,393
		Urban	183,676	215,125	273,784	318,462
		Total	1,371,399	1,594,338	1,974,697	2,214,855
	Kothari	Rural	430,991	500,035	615,975	686,512
		Urban	359,483	418,174	530,521	620,907
		Total	790,474	918,209	1,146,496	1,307,419
	Mashi	Rural	1,270,102	1,477,098	1,825,073	2,036,077
		Urban	210,304	246,187	311,604	358,010
		Total	1,480,406	1,723,285	2,136,677	2,394,087
	Morel	Rural	1,620,755	1,902,085	2,378,971	2,665,170
		Urban	3,327,600	4,234,411	5,937,510	7,020,292
		Total	4,948,355	6,136,496	8,316,481	9,685,462
	Sodra	Rural	208,637	238,194	287,101	317,572
		Urban	36,028	42,480	54,633	63,895
		Total	244,665	280,674	341,734	381,467
	Basin Total	Rural	9,333,996	10,824,272	13,328,561	14,853,623
		Urban	5,560,123	6,861,047	9,314,923	10,983,206
		Total	14,894,119	17,685,319	22,643,484	25,836,829
Chambal	Chakan	Rural	113,636	129,187	154,863	170,988
		Urban	11,077	12,860	16,244	18,952
		Total	124,713	142,047	171,107	189,940
	Chambal Downstream	Rural	788,686	892,626	1,066,948	1,177,791
		Urban	1,204,404	1,568,544	2,231,957	2,640,863
		Total	1,993,090	2,461,170	3,298,905	3,818,654
	Chambal Upstream	Rural	520,514	603,278	743,193	828,627
		Urban	66,988	76,505	95,154	111,244
		Total	587,502	679,783	838,347	939,871
	Kali Sindh	Rural	1,757,550	1,977,864	2,342,637	2,576,915
		Urban	403,734	514,529	723,167	865,141
		Total	2,161,284	2,492,393	3,065,804	3,442,056
	Kunu	Rural	75,096	84,604	100,163	110,109
		Urban	0	0	0	0
		Total	75,096	84,604	100,163	110,109
	Mej	Rural	904,452	1,020,907	1,212,212	1,334,064
		Urban	180,389	209,448	264,653	308,847
		Total	1,084,841	1,230,355	1,476,865	1,642,911
	Parwati	Rural	718,749	802,526	939,557	1,029,107
		Urban	221,837	293,602	428,540	517,825

River Basin	Sub Basin	Type	2010	2020	2040	2060
		Total	940,586	1,096,128	1,368,097	1,546,932
	Basin Total	Rural	4,878,683	5,510,991	6,559,574	7,227,600
		Urban	2,088,429	2,675,488	3,759,715	4,462,872
		Total	6,967,112	8,186,479	10,319,289	11,690,472
Mahi	Anas	Rural	559,169	700,387	955,838	1,103,471
		Urban	10,666	10,828	11,603	14,615
		Total	569,835	711,215	967,441	1,118,086
	Bhadar	Rural	100,929	123,060	163,742	189,681
		Urban	0	0	0	0
		Total	100,929	123,060	163,742	189,681
	Jakham	Rural	402,080	484,799	629,093	714,092
		Urban	29,728	29,843	31,391	38,140
		Total	431,808	514,642	660,484	752,232
	Mahi	Rural	1,808,455	2,239,767	3,018,378	3,478,406
		Urban	163,741	166,600	178,330	221,145
		Total	1,972,196	2,406,367	3,196,708	3,699,551
	Moran	Rural	235,017	286,552	381,283	441,683
		Urban	29,439	35,205	41,731	43,235
		Total	264,456	321,757	423,014	484,918
	Som	Rural	1,544,141	1,861,186	2,418,679	2,753,724
		Urban	127,351	151,634	191,256	216,753
		Total	1,671,492	2,012,820	2,609,935	2,970,477
	Basin Total	Rural	4,649,791	5,695,752	7,567,014	8,681,058
		Urban	360,925	394,110	454,311	533,888
		Total	5,010,716	6,089,862	8,021,325	9,214,946
Sabarmati	Sabarmati	Rural	123,495	148,131	190,760	215,865
		Urban	0	0	0	0
		Total	123,495	148,131	190,760	215,865
	Sei	Rural	93,775	112,480	144,850	163,913
		Urban	0	0	0	0
		Total	93,775	112,480	144,850	163,913
	Vatrak	Rural	263,134	319,944	423,300	488,327
		Urban	6,891	8,241	9,769	10,121
		Total	270,025	328,185	433,069	498,448
	Wakal	Rural	313,464	376,664	486,177	550,583
		Urban	0	0	0	0
		Total	313,464	376,664	486,177	550,583
	Basin Total	Rural	793,868	957,219	1,245,087	1,418,689
		Urban	6,891	8,241	9,769	10,121
		Total	800,759	965,460	1,254,856	1,428,810
Luni	Bandi	Rural	119,420	144,480	188,363	214,102
		Urban	0	0	0	0
		Total	119,420	144,480	188,363	214,102
	Bandi (Hemawas)	Rural	202,155	222,542	255,613	278,142
		Urban	242,079	269,651	321,915	367,486
		Total	444,234	492,193	577,528	645,628
	Guhiya	Rural	499,590	558,625	656,451	720,323
		Urban	55,495	61,816	73,797	84,244
		Total	555,085	620,441	730,248	804,567
	Jawai	Rural	398,498	463,123	574,241	642,168
		Urban	136,094	162,325	217,746	267,643
		Total	534,592	625,448	791,987	909,811

River Basin	Sub Basin	Type	2010	2020	2040	2060
	Jojri	Rural	1,076,388	1,255,401	1,559,553	1,743,864
		Urban	275,138	339,076	461,374	550,009
		Total	1,351,526	1,594,477	2,020,927	2,293,873
	Khari	Rural	378,709	454,813	587,234	665,288
		Urban	44,957	57,156	80,764	97,362
		Total	423,666	511,969	667,998	762,650
	Khari (Hemawas)	Rural	143,480	157,771	180,846	196,617
		Urban	0	0	0	0
		Total	143,480	157,771	180,846	196,617
	Luni	Rural	4,769,532	5,944,751	8,087,451	9,334,600
		Urban	2,106,227	2,496,947	3,233,892	3,796,873
		Total	6,875,759	8,441,698	11,321,343	13,131,473
	Mithari	Rural	239,655	273,640	331,461	367,745
		Urban	61,448	68,446	81,713	93,280
		Total	301,103	342,086	413,174	461,025
	Sagi	Rural	214,919	263,770	350,263	400,565
		Urban	47,932	57,656	79,735	101,730
		Total	262,851	321,426	429,998	502,295
	Sukri	Rural	376,363	420,672	494,575	542,952
		Urban	41,270	45,971	54,881	62,650
		Total	417,633	466,643	549,456	605,602
	Sukri (Sayala)	Rural	166,032	204,133	271,757	311,070
		Urban	0	0	0	0
		Total	166,032	204,133	271,757	311,070
	Basin Total	Rural	8,584,741	10,363,720	13,537,810	15,417,434
		Urban	3,010,640	3,559,044	4,605,817	5,421,277
		Total	11,595,381	13,922,764	18,143,627	20,838,711
West Banas	Basin Total	Rural	328,267	382,247	473,026	527,974
		Urban	127,527	162,130	229,098	276,179
		Total	455,794	544,377	702,124	804,153
Sukli	Basin Total	Rural	191,980	223,559	276,665	308,807
		Urban	8,117	10,319	14,581	17,578
		Total	200,097	233,878	291,246	326,385
Other Nallahs of Jalore	Basin Total	Rural	322,591	393,806	519,405	592,670
		Urban	32,875	39,544	54,687	69,772
		Total	355,466	433,350	574,092	662,442
Ghaggar	Basin Total	Rural	755,643	840,196	979,905	1,072,404
		Urban	315,381	347,652	408,881	466,074
		Total	1,071,024	1,187,848	1,388,786	1,538,478
Outside	Fragmented	Rural	121,067	137,042	164,391	181,862
		Urban	47,138	53,757	65,825	75,186
		Total	168,205	190,799	230,216	257,048
	Sub 1	Rural	955,587	1,045,935	1,194,131	1,297,253
		Urban	379,619	424,805	507,028	575,129
		Total	1,335,206	1,470,740	1,701,159	1,872,382
	Sub 2	Rural	461,826	526,116	636,353	705,921
		Urban	29,990	33,656	40,281	45,649
		Total	491,816	559,772	676,634	751,570
	Sub 3	Rural	3,339,047	3,783,546	4,527,955	5,000,130
		Urban	1,057,297	1,218,883	1,515,169	1,748,392
		Total	4,396,344	5,002,429	6,043,124	6,748,522
	Sub 4	Rural	1,996,150	2,356,978	2,978,084	3,349,811

River Basin	Sub Basin	Type	2010	2020	2040	2060
		Urban	1,291,419	1,537,335	1,992,327	2,322,453
		Total	3,287,569	3,894,313	4,970,411	5,672,264
	Sub 5	Rural	2,787,033	3,334,847	4,296,132	4,866,984
		Urban	464,214	553,653	719,965	850,799
		Total	3,251,247	3,888,500	5,016,097	5,717,783
	Sub 6	Rural	595,677	774,842	1,112,568	1,307,165
		Urban	0	0	0	0
		Total	595,677	774,842	1,112,568	1,307,165
	Basin Total	Rural	10,256,387	11,959,305	14,909,615	16,709,126
		Urban	3,269,677	3,822,089	4,840,595	5,617,608
		Total	13,526,064	15,781,394	19,750,210	22,326,734
State Total		Rural	51,500,352	60,430,181	75,843,943	85,177,312
		Urban	17,048,085	20,713,556	27,626,864	32,589,289
		Total	68,548,437	81,143,737	103,470,807	117,766,601

Note: As per Final Report No. 4.7

Table 8.6: Basin-wise Present (2010) and Projected Population

River Basin	Type	2010	2020	2040	2060
Shekhawati	Rural	2,757,551	3,115,537	3,707,955	4,085,076
	Urban	514,399	641,371	879,434	1,041,806
	Total	3,271,950	3,756,908	4,587,389	5,126,882
Ruparail	Rural	1,510,141	1,774,242	2,222,546	2,491,313
	Urban	483,479	631,521	921,388	1,123,538
	Total	1,993,620	2,405,763	3,143,934	3,614,851
Banganga	Rural	3,328,009	3,932,241	4,963,187	5,577,816
	Urban	603,685	723,692	962,311	1,153,883
	Total	3,931,694	4,655,933	5,925,498	6,731,699
Gambhir	Rural	1,586,225	1,871,005	2,355,855	2,645,326
	Urban	266,446	314,184	409,162	488,507
	Total	1,852,671	2,185,189	2,765,017	3,133,833
Parbati	Rural	503,064	589,377	735,340	823,074
	Urban	80,709	103,793	148,671	179,849
	Total	583,773	693,170	884,011	1,002,923
Sabi	Rural	1,719,413	1,996,712	2,462,399	2,745,322
	Urban	318,782	419,331	613,521	743,131
	Total	2,038,195	2,416,043	3,075,920	3,488,453
Banas	Rural	9,333,996	10,824,272	13,328,561	14,853,623
	Urban	5,560,123	6,861,047	9,314,923	10,983,206
	Total	14,894,119	17,685,319	22,643,484	25,836,829
Chambal	Rural	4,878,683	5,510,991	6,559,574	7,227,600
	Urban	2,088,429	2,675,488	3,759,715	4,462,872
	Total	6,967,112	8,186,479	10,319,289	11,690,472
Mahi	Rural	4,649,791	5,695,752	7,567,014	8,681,058
	Urban	360,925	394,110	454,311	533,888
	Total	5,010,716	6,089,862	8,021,325	9,214,946
Sabarmati	Rural	793,868	957,219	1,245,087	1,418,689

River Basin	Type	2010	2020	2040	2060
	Urban	6,891	8,241	9,769	10,121
	Total	800,759	965,460	1,254,856	1,428,810
Luni	Rural	8,584,741	10,363,720	13,537,810	15,417,434
	Urban	3,010,640	3,559,044	4,605,817	5,421,277
	Total	11,595,381	13,922,764	18,143,627	20,838,711
West Banas	Rural	328,267	382,247	473,026	527,974
	Urban	127,527	162,130	229,098	276,179
	Total	455,794	544,377	702,124	804,153
Sukli	Rural	191,980	223,559	276,665	308,807
	Urban	8,117	10,319	14,581	17,578
	Total	200,097	233,878	291,246	326,385
Other Nallahs of Jalore	Rural	322,591	393,806	519,405	592,670
	Urban	32,875	39,544	54,687	69,772
	Total	355,466	433,350	574,092	662,442
Ghaggar	Rural	755,643	840,196	979,905	1,072,404
	Urban	315,381	347,652	408,881	466,074
	Total	1,071,024	1,187,848	1,388,786	1,538,478
Outside	Rural	10,256,387	11,959,305	14,909,615	16,709,126
	Urban	3,269,677	3,822,089	4,840,595	5,617,608
	Total	13,526,064	15,781,394	19,750,210	22,326,734
State Total	Rural	51,500,352	60,430,181	75,843,943	85,177,312
	Urban	17,048,085	20,713,556	27,626,864	32,589,289
	Total	68,548,437	81,143,737	103,470,807	117,766,601

Note: As per Final Report No. 4.7

Table 8.7: District-wise Present (2010) and Projected Population

S. No.	District	Population 2010 (as per Census 2011)			Population 2020			Population 2040			Population 2060		
		Rural	Urban	Total	Rural	Urban	Total	Rural	Urban	Total	Rural	Urban	Total
1	Ajmer	1,547,642	1,035,410	2,583,052	1,805,097	1,181,179	2,986,276	2,238,676	1,441,940	3,680,616	2,500,604	1,637,215	4,137,819
2	Alwar	3,019,728	654,451	3,674,179	3,512,696	877,801	4,390,497	4,340,908	1,315,605	5,656,513	4,842,844	1,614,050	6,456,894
3	Banswara	1,669,864	127,621	1,797,485	2,091,591	129,557	2,221,148	2,854,451	138,827	2,993,278	3,295,336	174,862	3,470,198
4	Baran	968,541	254,214	1,222,755	1,091,166	336,453	1,427,619	1,291,842	491,085	1,782,927	1,420,118	593,401	2,013,519
5	Barmer	2,421,914	181,837	2,603,751	3,140,276	193,752	3,334,028	4,489,460	223,590	4,713,050	5,266,738	288,141	5,554,879
6	Bharatpur	2,053,363	495,099	2,548,462	2,448,804	562,956	3,011,760	3,128,938	694,061	3,822,999	3,531,104	810,570	4,341,674
7	Bhilwara	1,895,869	512,654	2,408,523	2,213,940	596,353	2,810,293	2,750,199	756,570	3,506,769	3,073,698	885,467	3,959,165
8	Bikaner	1,563,553	800,384	2,363,937	1,900,121	956,107	2,856,228	2,490,004	1,244,827	3,734,831	2,834,630	1,450,511	4,285,141
9	Bundi	888,205	222,701	1,110,906	996,114	258,535	1,254,649	1,172,143	326,566	1,498,709	1,285,837	381,005	1,666,842
10	Chittaurgarh	1,259,074	285,264	1,544,338	1,431,959	321,587	1,753,546	1,716,914	392,838	2,109,752	1,895,632	456,600	2,352,232
11	Churu	1,463,312	576,235	2,039,547	1,746,510	645,071	2,391,581	2,233,972	770,189	3,004,161	2,522,035	877,440	3,399,475
12	Dausa	1,432,616	201,793	1,634,409	1,707,696	264,412	1,972,108	2,180,593	393,487	2,574,080	2,460,324	491,191	2,951,515
13	Dhaulpur	959,066	247,450	1,206,516	1,122,769	318,224	1,440,993	1,399,405	455,818	1,855,223	1,565,818	551,407	2,117,225
14	Dungarpur	1,299,809	88,743	1,388,552	1,584,833	106,125	1,690,958	2,108,758	125,799	2,234,557	2,442,811	130,332	2,573,143
15	Ganganagar	1,433,736	535,432	1,969,168	1,528,393	600,889	2,129,282	1,680,485	719,176	2,399,661	1,801,030	815,026	2,616,056
16	Hanumangarh	1,424,228	350,464	1,774,692	1,646,573	381,608	2,028,181	2,018,092	443,311	2,461,403	2,245,065	507,419	2,752,484
17	Jaipur	3,154,331	3,471,847	6,626,178	3,685,169	4,432,299	8,117,468	4,580,510	6,232,596	10,813,106	5,120,353	7,365,544	12,485,897
18	Jaisalmer	580,894	89,025	669,919	760,287	93,394	853,681	1,100,728	98,251	1,198,979	1,296,943	113,032	1,409,975
19	Jalore	1,676,975	151,755	1,828,730	2,058,154	182,542	2,240,696	2,733,042	252,446	2,985,488	3,125,541	322,083	3,447,624
20	Jhalawar	1,181,838	229,291	1,411,129	1,361,047	284,885	1,645,932	1,659,482	393,375	2,052,857	1,842,820	474,488	2,317,308
21	Jhunjhunu	1,647,966	489,079	2,137,045	1,774,908	567,156	2,342,064	1,978,523	708,790	2,687,313	2,130,464	817,304	2,947,768
22	Jodhpur	2,422,551	1,264,614	3,687,165	3,008,125	1,559,129	4,567,254	4,057,646	2,117,329	6,174,975	4,665,544	2,501,312	7,166,856
23	Karauli	1,240,143	218,105	1,458,248	1,458,602	255,181	1,713,783	1,829,369	329,857	2,159,226	2,051,316	394,566	2,445,882
24	Kota	774,410	1,176,604	1,951,014	816,939	1,542,190	2,359,129	885,750	2,202,261	3,088,011	944,743	2,599,535	3,544,278
25	Nagaur	2,670,539	637,204	3,307,743	3,062,337	785,231	3,847,568	3,712,441	1,068,773	4,781,214	4,114,452	1,275,866	5,390,318
26	Pali	1,577,567	460,006	2,037,573	1,725,551	512,399	2,237,950	1,963,676	611,713	2,575,389	2,129,531	698,308	2,827,839
27	Pratapgarh	796,041	71,807	867,848	965,023	72,085	1,037,108	1,260,451	75,824	1,336,275	1,433,273	92,125	1,525,398
28	Rajsamand	972,777	183,820	1,156,597	1,090,167	234,425	1,324,592	1,281,569	330,510	1,612,079	1,405,404	399,069	1,804,473
29	Sawai Madhopur	1,069,084	266,467	1,335,551	1,244,961	312,880	1,557,841	1,540,731	402,363	1,943,094	1,719,744	473,702	2,193,446
30	Sikar	2,043,427	633,906	2,677,333	2,275,848	786,716	3,062,564	2,653,275	1,068,027	3,721,302	2,901,362	1,261,774	4,163,136
31	Sirohi	827,692	208,654	1,036,346	963,842	265,270	1,229,112	1,192,802	374,839	1,567,641	1,331,380	451,872	1,783,252
32	Tonk	1,103,603	317,723	1,421,326	1,254,710	374,621	1,629,331	1,503,702	481,794	1,985,496	1,659,964	563,470	2,223,434
33	Udaipur	2,459,994	608,426	3,068,420	2,955,973	722,544	3,678,517	3,815,406	944,427	4,759,833	4,320,854	1,120,602	5,441,456
	State Total	51,500,352	17,048,085	68,548,437	60,430,181	20,713,556	81,143,737	75,843,943	27,626,864	103,470,807	85,177,312	32,589,289	117,766,601

Note: As per Final Report No. 4.6

9. Non-Agricultural Water Demands

9.1 Introduction

By pertinent nature, non-agricultural water demand values are reflected in terms of administrative division of the State, i.e. Districts and Blocks. The water demands calculated for various non-agricultural sectors (i.e. Domestic, Institutional, Industrial, Livestock, Wildlife and Power) either on Block level or on specific locations were transferred to Basins / Sub-Basins using GIS overlay techniques. The details of the non-agricultural water demand assessment block-wise/district-wise have been presented in detail in Final Report No. 4.6 and the non-agricultural water demand assessment basin-wise/sub basin-wise/micro watershed-wise have been presented in detail in Final Report No. 4.7.

9.2 Domestic and Institutional Water Demand

For assessing domestic water demand, for the year 2010, the Consultants have adopted the norms established by the PHED, as follows, in litres per capita per day (lpcd).

Rural Water Supply

70 lpcd in DDP[1] Blocks of Rajasthan
40 lpcd in non-DDP Blocks

Urban Water Supply

135 lpcd in towns having a population of more than 20,000
100 lpcd in towns having a population of less than 20,000

Revised norms of Water Supply

The Chief Engineer (HQ), PHED, Rajasthan Jaipur vide his letter No. CE(R)/2012-13/4008 dated 13.08.2012 intimated that as per new guidelines of NRDWP issued by MORD, Govt. of India, the norms be taken as below.

(A) Domestic Water Demand of Urban Population

For water demand of major towns of Rajasthan i.e. Jaipur, Jodhpur, Bikaner and Kota, a norm of 150 lpcd should be taken, as sewerage system are to be executed along with drinking water supply in these towns.

(B) Domestic Water Demand of Rural Population

To cover maximum habitation through piped water supply schemes, the above norms should be replaced with 100 lpcd in DDP blocks and 70 lpcd in non DDP blocks for planning water demand for rural population due to future needs of conversion of existing drinking water schemes (from present hand pump schemes,

[1] DDP = Drought Development Programme

pump and tank etc. to Piped Water Supply Schemes in maximum possible habitations).

Hence, the future domestic water demands for the year 2020, 2040 and 2060 have been worked out as per the norms laid down in this letter considering the 15 lpcd extra demand in Urban areas for sewerage in the major towns having population more than 5.0 lac. Similarly in Rural areas 100 lpcd in DDP Blocks and 70 lpcd in Non-DDP Blocks has been considered to work out the future domestic water demands for the year 2020, 2040 and 2060.

The domestic water demand is calculated separately for Urban and Rural areas for each Block. Urban water demand is calculated for Towns / Cities and Rural domestic water demand calculated for Blocks. Further, the gross demand was estimated by considering 30 losses in urban areas and 10% losses in rural areas. The relation between Block and Basin / Sub-Basin has been achieved by GIS on area proportional basis; accordingly, the rural gross water demand has been transferred to Basin / Sub-Basin level. Concerning urban areas (i.e. Town / City), their location in terms of Micro watershed has been achieved by GIS, and per case basis of their location in relevant Basin / Sub-Basin, the urban gross water demand has been transferred.

Accordingly, the basin wise annual gross domestic water demand for 2010 and projected gross water demand for year 2020, 2040 and 2060 have been presented in Table 9.1 also showing present and projected population.

Table 9.1: Projected River Basin Population and Gross Domestic Water Demand

River Basin	Type	2010		2020		2040		2060	
		Popul-ation, millions	Demand, Mm^3/yr	Popul-ation, millions	Demand, Mm^3/yr	Popul-ation, millions	Demand, Mm^3/yr	Popul-ation, millions	Demand, Mm^3/yr
Shekhawati	Rural	2.76	67.58	3.12	113.89	3.71	134.89	4.09	148.38
	Urban	0.51	33.75	0.64	42.53	0.88	59.83	1.04	70.84
	Total	3.27	101.33	3.76	156.42	4.59	194.72	5.13	219.22
Ruparail	Rural	1.51	25.89	1.77	52.01	2.22	65.12	2.49	72.97
	Urban	0.48	33.09	0.63	43.20	0.92	69.38	1.12	84.65
	Total	1.99	58.98	2.41	95.21	3.14	134.50	3.61	157.62
Banganga	Rural	3.33	53.99	3.93	111.64	4.96	140.90	5.58	158.36
	Urban	0.60	41.09	0.72	50.48	0.96	67.49	1.15	80.91
	Total	3.93	95.08	4.66	162.12	5.93	208.39	6.73	239.27
Gambhir	Rural	1.59	25.74	1.87	53.10	2.36	66.87	2.65	75.10
	Urban	0.27	18.65	0.31	21.99	0.41	28.66	0.49	34.23
	Total	1.85	44.39	2.19	75.09	2.77	95.53	3.13	109.33
Parbati	Rural	0.50	8.17	0.59	16.72	0.74	20.87	0.82	23.37
	Urban	0.08	5.35	0.10	7.30	0.15	10.46	0.18	12.67
	Total	0.58	13.52	0.69	24.02	0.88	31.33	1.00	36.04
Sabi	Rural	1.72	30.27	2.00	59.35	2.46	73.10	2.75	81.44
	Urban	0.32	21.57	0.42	28.38	0.61	42.46	0.74	52.29

River Basin	Type	2010		2020		2040		2060	
		Popul-ation, millions	Demand, Mm^3/yr	Popul-ation, millions	Demand, Mm^3/yr	Popul-ation, millions	Demand, Mm^3/yr	Popul-ation, millions	Demand, Mm^3/yr
	Total	2.04	51.84	2.42	87.73	3.08	115.56	3.49	133.73
Banas	Rural	9.33	160.74	10.82	318.12	13.33	391.74	14.85	436.53
	Urban	5.56	385.14	6.86	511.62	9.31	703.69	10.98	831.47
	Total	14.89	545.88	17.69	829.74	22.64	1,095.43	25.84	1,268.00
Chambal	Rural	4.88	79.20	5.51	156.44	6.56	186.20	7.23	205.14
	Urban	2.09	142.96	2.68	194.69	3.76	276.30	4.46	329.80
	Total	6.97	222.16	8.19	351.13	10.32	462.50	11.69	534.94
Mahi	Rural	4.65	75.44	5.70	161.72	7.57	214.78	8.68	246.47
	Urban	0.36	22.83	0.39	25.24	0.45	29.82	0.53	35.44
	Total	5.01	98.27	6.09	186.96	8.02	244.60	9.21	281.91
Sabarmati	Rural	0.79	13.77	0.96	28.25	1.25	36.74	1.42	41.84
	Urban	0.01	0.36	0.01	0.43	0.01	0.51	0.01	0.53
	Total	0.80	14.13	0.97	28.68	1.25	37.25	1.43	42.37
Luni	Rural	8.58	234.48	10.36	409.77	13.54	535.71	15.42	610.25
	Urban	3.01	208.88	3.56	263.57	4.61	341.83	5.42	403.05
	Total	11.60	443.36	13.92	673.34	18.14	877.54	20.84	1,013.30
West Banas	Rural	0.33	5.33	0.38	10.85	0.47	13.44	0.53	14.99
	Urban	0.13	8.54	0.16	10.84	0.23	15.83	0.28	19.07
	Total	0.46	13.87	0.54	21.69	0.70	29.27	0.80	34.06
Sukli	Rural	0.19	3.12	0.22	6.35	0.28	7.85	0.31	8.77
	Urban	0.01	0.43	0.01	0.54	0.01	0.76	0.02	0.91
	Total	0.20	3.55	0.23	6.89	0.29	8.61	0.33	9.68
Other Nallahs of Jalore	Rural	0.32	8.46	0.39	15.15	0.52	20.01	0.59	22.85
	Urban	0.03	2.31	0.04	2.79	0.05	3.84	0.07	4.91
	Total	0.36	10.77	0.43	17.94	0.57	23.85	0.66	27.76
Ghaggar	Rural	0.76	12.27	0.84	23.85	0.98	27.81	1.07	30.45
	Urban	0.32	21.75	0.35	24.33	0.41	28.58	0.47	32.62
	Total	1.07	34.02	1.19	48.18	1.39	56.39	1.54	63.07
Outside	Rural	10.26	269.02	11.96	459.99	14.91	575.15	16.71	645.22
	Urban	3.27	225.21	3.82	271.37	4.84	344.90	5.62	401.44
	Total	13.53	494.23	15.78	731.36	19.75	920.05	22.33	1,046.66
Grand Total	Rural	51.50	1,073.46	60.43	1,997.20	75.84	2,511.20	85.18	2,822.13
	Urban	17.05	1,171.91	20.71	1,499.30	27.63	2,024.34	32.59	2,394.83
	Total	68.55	2,245.37	81.14	3,496.50	103.47	4,535.54	117.77	5,216.96

Note: As per Final Report No. 4.7

The institutional demand is considered as 5% of domestic demand, accordingly institutional demand has been added to Basin / Sub-Basin level urban and rural gross domestic water demand. Table 9.2(a) shows the combined basin wise domestic and institutional gross water demand and Table 9.2(b) shows the combined district wise domestic and institutional gross water demand.

Table 9.2(a): Combined Basin wise Domestic and Institutional Gross Water Demand

River Basin	Type	Combined Domestic and Institutional Gross Water Demand, Mm^3/yr			
		2010	2020	2040	2060
Shekhawati	Rural	70.96	119.58	141.63	155.80
	Urban	35.44	44.66	62.82	74.38
	Total	106.40	164.24	204.46	230.18
Ruparail	Rural	27.18	54.61	68.38	76.62
	Urban	34.74	45.36	72.85	88.88
	Total	61.93	99.97	141.23	165.50
Banganga	Rural	56.69	117.22	147.95	166.28
	Urban	43.14	53.00	70.86	84.96
	Total	99.83	170.23	218.81	251.23
Gambhir	Rural	27.03	55.76	70.21	78.86
	Urban	19.58	23.09	30.09	35.94
	Total	46.61	78.84	100.31	114.80
Parbati	Rural	8.58	17.56	21.91	24.54
	Urban	5.62	7.67	10.98	13.30
	Total	14.20	25.22	32.90	37.84
Sabi	Rural	31.78	62.32	76.76	85.51
	Urban	22.65	29.80	44.58	54.90
	Total	54.43	92.12	121.34	140.42
Banas	Rural	168.78	334.03	411.33	458.36
	Urban	404.40	537.20	738.87	873.04
	Total	573.17	871.23	1,150.20	1,331.40
Chambal	Rural	83.16	164.26	195.51	215.40
	Urban	150.11	204.42	290.12	346.29
	Total	233.27	368.69	485.63	561.69
Mahi	Rural	79.21	169.81	225.52	258.79
	Urban	23.97	26.50	31.31	37.21
	Total	103.18	196.31	256.83	296.01
Sabarmati	Rural	14.46	29.66	38.58	43.93
	Urban	0.38	0.45	0.54	0.56
	Total	14.84	30.11	39.11	44.49
Luni	Rural	246.20	430.26	562.50	640.76
	Urban	219.32	276.75	358.92	423.20
	Total	465.53	707.01	921.42	1,063.97
West Banas	Rural	5.60	11.39	14.11	15.74
	Urban	8.97	11.38	16.62	20.02
	Total	14.56	22.77	30.73	35.76
Sukli	Rural	3.28	6.67	8.24	9.21
	Urban	0.45	0.57	0.80	0.96
	Total	3.73	7.23	9.04	10.16
Other	Rural	8.88	15.91	21.01	23.99

River Basin	Type	Combined Domestic and Institutional Gross Water Demand, Mm^3/yr			
		2010	2020	2040	2060
Nallahs of Jalore	Urban	2.43	2.93	4.03	5.16
	Total	11.31	18.84	25.04	29.15
Ghaggar	Rural	12.88	25.04	29.20	31.97
	Urban	22.84	25.55	30.01	34.25
	Total	35.72	50.59	59.21	66.22
Outside	Rural	282.47	482.99	603.91	677.48
	Urban	236.47	284.94	362.15	421.51
	Total	518.94	767.93	966.05	1,098.99
Grand Total	Rural	1,127.13	2,097.06	2,636.76	2,963.24
	Urban	1,230.51	1,574.27	2,125.56	2,514.57
	Total	2,357.64	3,671.33	4,762.32	5,477.81

Note: As per Final Report No. 4.7

Table 9.2(b): Combined District wise Domestic and Institutional Gross Water Demand

S. No.	District	Combined Domestic and Institutional Gross Water Demand, Mm^3/yr											
		2010			2020			2040			2060		
		Rural	Urban	Total	Rural	Urban	Total	Rural	Urban	Total	Rural	Urban	Total
1	Ajmer	32.56	76.13	108.69	61.03	91.97	153.00	75.69	112.22	187.92	84.54	127.45	211.98
2	Alwar	53.81	46.31	100.12	107.46	62.57	170.03	132.81	100.95	233.76	148.20	124.77	272.97
3	Banswara	28.43	8.93	37.36	62.36	9.05	71.41	85.06	9.70	94.76	98.23	12.22	110.45
4	Baran	16.52	17.93	34.45	32.52	24.18	56.70	38.50	35.68	74.18	42.33	43.53	85.86
5	Barmer	72.20	13.22	85.42	133.71	14.09	147.80	191.16	16.25	207.42	224.26	20.97	245.23
6	Bharatpur	34.99	35.72	70.71	73.02	41.49	114.50	93.28	51.17	144.45	105.25	59.72	164.98
7	Bhilwara	32.31	36.46	68.76	65.99	42.85	108.84	81.99	59.97	141.96	91.62	70.53	162.15
8	Bikaner	44.47	58.38	102.85	78.32	76.51	154.83	102.63	99.61	202.24	116.85	116.47	233.32
9	Bundi	15.15	15.65	30.80	29.68	18.57	48.26	34.93	23.49	58.42	38.31	27.39	65.71
10	Chittaurgarh	21.44	20.57	42.01	42.69	23.17	65.87	51.16	28.74	79.89	56.51	33.39	89.90
11	Churu	43.61	41.97	85.58	74.39	47.40	121.79	95.13	56.63	151.76	107.38	64.50	171.89
12	Dausa	24.40	14.68	39.08	50.90	19.23	70.13	65.00	29.07	94.07	73.34	36.31	109.65
13	Dhaulpur	16.34	17.94	34.28	33.45	23.50	56.95	41.71	33.69	75.40	46.67	40.77	87.44
14	Dungarpur	22.13	6.33	28.47	47.25	7.57	54.82	62.86	8.98	71.84	72.83	9.30	82.13
15	Ganganagar	24.43	37.24	61.68	45.56	42.63	88.19	50.07	50.97	101.04	53.69	58.18	111.87
16	Hanumangarh	30.84	25.90	56.74	56.68	28.18	84.86	69.46	32.75	102.21	77.29	37.51	114.80
17	Jaipur	58.22	255.30	313.52	115.11	357.81	472.92	143.08	504.37	647.45	159.92	596.47	756.39
18	Jaisalmer	17.31	6.58	23.90	32.37	6.90	39.27	46.87	7.27	54.14	55.23	8.36	63.59
19	Jalore	46.53	10.89	57.41	83.41	13.51	96.93	110.74	18.64	129.38	126.68	23.80	150.49
20	Jhalawar	20.14	15.86	35.99	40.56	19.74	60.30	49.48	28.09	77.56	54.92	34.72	89.64
21	Jhunjhunu	49.11	33.55	82.66	75.61	39.72	115.33	84.24	51.00	135.24	90.74	59.18	149.92
22	Jodhpur	69.89	93.46	163.35	125.23	125.94	251.17	168.96	171.05	340.00	194.25	202.05	396.30
23	Karauli	21.13	16.00	37.13	43.47	18.71	62.18	54.53	24.18	78.71	61.15	28.94	90.09

S. No.	District	Combined Domestic and Institutional Gross Water Demand, Mm^3/yr											
		2010			2020			2040			2060		
		Rural	Urban	Total	Rural	Urban	Total	Rural	Urban	Total	Rural	Urban	Total
24	Kota	13.19	85.73	98.92	24.36	123.52	147.88	26.39	177.25	203.64	28.15	210.03	238.18
25	Nagaur	79.59	45.44	125.03	130.41	57.16	187.57	158.13	78.27	236.40	175.19	93.85	269.04
26	Pali	47.02	32.58	79.60	73.47	36.68	110.15	83.62	44.24	127.86	90.68	50.94	141.61
27	Pratapgarh	13.58	4.74	18.31	28.76	4.76	33.52	37.56	5.01	42.57	42.72	6.53	49.26
28	Rajsamand	19.76	12.14	31.90	36.10	16.40	52.50	42.45	23.88	66.33	46.56	28.81	75.37
29	Sawai Madhopur	18.22	19.20	37.42	37.12	22.53	59.65	45.94	29.42	75.36	51.24	34.63	85.87
30	Sikar	60.92	45.71	106.63	96.93	56.77	153.70	112.99	78.05	191.04	123.55	92.20	215.75
31	Sirohi	15.56	14.70	30.26	30.44	18.68	49.12	37.66	26.91	64.58	42.03	32.42	74.46
32	Tonk	18.80	22.87	41.66	37.40	26.93	64.33	44.85	34.63	79.47	49.48	41.38	90.86
33	Udaipur	44.55	42.41	86.96	91.30	55.53	146.83	117.82	73.46	191.28	133.44	87.23	220.68
	State Total	**1127.13**	**1230.51**	**2357.64**	**2097.06**	**1574.27**	**3671.33**	**2636.76**	**2125.56**	**4762.32**	**2963.24**	**2514.57**	**5477.81**

Note: As per Final Report No. 4.6

9.3 Livestock Water Demand

The current livestock population i.e. population in 2010 is not available with Animal Husbandry Department of Rajasthan. The Animal Husbandry department of Rajasthan State does livestock census in every five years. The latest livestock census was carried out in 2007 and the next livestock census is carried out in October / November 2012, the results of which are still not published till the end of January 2014. The figures of livestock census of 2007 upto Tehsil and village level have been collected from the Animal Husbandry department of GoR.

There is no definite trend of the livestock i.e. increasing or decreasing. The Rajasthan State is a drought prone State. It faces frequent droughts, almost once in 3-4 years and sometime continuously for three four years. This affects livestock population. Thousands even lacs of animals die in drought years due to shortage of water and fodder. Therefore, some definite criteria cannot be evolved for future projections of the livestock. The livestock population was 49.650 million in 1983. It decreased to 40.917 million in 1988 and increased to 48.445 million in 1992 and again increased to 54.055 million in 1997 and then decreased to 49.136 million in 2003 and again increased to 56.585 million in 2007. Thus some time the population is increasing and some time decreasing. After 2007, there has been drought in 2008 and 2009 where as there have been good rains in 2010 and 2011 in the State. In these circumstances, no definite predictions can be made about livestock population. The matter of livestock projections was discussed with the statistical wing of Animal Husbandry Department of GoR. They were of the same opinion that because of the above mentioned constraints, they do not do the livestock projections.

However, on the basis of available data of livestock census for 12 times (1951 to 2007), the trend diagrams for the various main categories of domestic animals, such as cattle, buffalos, sheep, goats, camels, pigs, poultry and remaining others (dogs, horses, donkeys, rabbits etc.) have been plotted. Viewing these graphs, it comes out that cattle population is very much fluctuating and has a decline trend. Buffalo, sheep and goat, though have fluctuating population, but overall have an increasing trend. Similarly trend diagram for camels is also very much fluctuating. There were rising trend in population from 1950 to 1970, then it remained almost constant upto 1985 and after that it is declining. One of its reason may be mechanisation due to which the demand of such animals has reduced which resulted decrement in their population. The trend diagram of pigs and poultry is almost similar though fluctuating but have increasing tread. The reason may be that these both supplement the food requirement of the people. The most important is the trend graph of the animals such as horses, donkeys, dogs, rabbits etc. Now a days, the people do not keep rabbits and dog population. This is also being discouraged by their sterilization. Similarly due to fast mechanisation the horse and donkey population is reducing at a fast pace.

However, based on available figures and trends projections of livestock for the year 2010, 2020, 2040 and 2060 have been done over the 2007 population census figures. Livestock growth factors for the year 2010, 2020, 2040 and 2060 over the 2007 population figures for different categories of the livestock have been worked

out. The basin-wise projected population of livestock for different categories have been shown in Table 9.3(a) to 9.3(d). The district-wise projected population of livestock for different categories have been shown in Table 9.3(e) to 9.3(h). The State-wise projected population of livestock for different categories have been shown in Table 9.3(i).

Table 9.3(a): Basin-wise Projected Livestock Population for year 2010

S. No.	Basin	Livestock Category								
		Cow	Buffalo	Sheep	Goat	Horse	Donkey	Camel	Pig	Poultry
1	Shekhawati	439766	771384	519105	1092975	826	1615	27720	20992	698353
2	Ruparail	90147	419954	64927	325624	235	816	4780	16549	326406
3	Banganga	244746	940224	157447	663770	803	1177	13557	42728	112949
4	Gambhir	114877	377903	60210	283147	338	996	6473	20208	13182
5	Parbati	73581	172812	7527	97395	44	158	745	3164	6711
6	Sabi	107927	506697	75676	363815	484	933	12343	8968	6367
7	Banas	2413426	2242161	1788020	3341786	4469	6021	35168	86656	1882080
8	Chambal	1532718	1290835	204473	1540271	2545	4842	13760	60608	225790
9	Mahi	1634694	795217	262297	1444324	760	5352	8012	3426	930028
10	Sabarmati	169651	71453	49529	179507	94	743	1006	64	43424
11	Luni	1763426	1319914	4698870	4607408	4592	25906	131112	39798	281557
12	West Banas	81532	44360	49677	132779	53	125	2248	4	0
13	Sukli	40432	57824	53712	55597	76	320	2928	0	0
14	Other Nallahs of Jalore	68716	85680	91211	84458	310	397	3368	21	0
15	Ghaggar	297274	153977	221630	189812	433	1943	18552	1322	122124
16	Outside Basin	2757771	1481950	5044909	5631023	5131	37725	383474	8738	574152
	Total	11830684	10732345	13349219	20033689	21190	89067	665247	313245	5223124

Note: As per Final Report No. 4.7

Table 9.3(b): Basin-wise Projected Livestock Population for year 2020

S. No.	Basin	Livestock Category								
		Cow	Buffalo	Sheep	Goat	Horse	Donkey	Camel	Pig	Poultry
1	Shekhawati	436097	875324	562328	1219044	688	1344	28481	24163	824453
2	Ruparail	89395	476540	70333	363183	196	679	4912	19049	385344
3	Banganga	242705	1066913	170556	740333	668	979	13930	49181	133343
4	Gambhir	113919	428823	65223	315806	281	829	6651	23260	15562
5	Parbati	72968	196097	8154	108629	37	131	765	3642	7923
6	Sabi	107026	574971	81977	405779	402	777	12682	10322	7517
7	Banas	2393293	2544279	1936898	3727245	3719	5011	36134	99745	2221923
8	Chambal	1519932	1464767	221498	1717934	2118	4030	14138	69763	266560
9	Mahi	1621057	902367	284136	1610919	632	4454	8232	3943	1097961
10	Sabarmati	168236	81080	53652	200212	78	618	1033	74	51265
11	Luni	1748716	1497765	5090116	5138850	3822	21561	134713	45809	332397
12	West Banas	80852	50337	53814	148094	44	104	2310	4	0
13	Sukli	40095	65615	58185	62010	63	267	3009	0	0
14	Other Nallahs Jalore	68143	97225	98806	94199	258	330	3461	24	0
15	Ghaggar	294794	174725	240084	211706	360	1617	19061	1521	144176
16	Outside Basin	2734766	1681634	5464968	6280533	4270	31398	394006	10058	677826
	Total	11731992	12178462	14460728	22344475	17636	74129	683518	360558	6166250

Note: As per Final Report No. 4.7

Table 9.3(c): Basin-wise Projected Livestock Population for year 2040

S. No.	Basin	Livestock Category								
		Cow	Buffalo	Sheep	Goat	Horse	Donkey	Camel	Pig	Poultry
1	Shekhawati	428760	1083202	649637	1470057	421	823	29986	30440	1077253
2	Ruparail	87891	589712	81253	437966	120	416	5171	23998	503502
3	Banganga	238621	1320292	197038	892775	409	599	14666	61959	174230
4	Gambhir	112002	530663	75350	380834	172	507	7002	29303	20333
5	Parbati	71740	242667	9420	130997	22	80	806	4588	10352
6	Sabi	105226	711520	94706	489333	246	475	13352	13004	9822
7	Banas	2353027	3148514	2237631	4494720	2276	3067	38044	125659	2903226
8	Chambal	1494360	1812631	255889	2071673	1297	2467	14885	87887	348295
9	Mahi	1593784	1116668	328253	1942623	387	2726	8667	4968	1434627
10	Sabarmati	165406	100336	61983	241437	48	378	1088	93	66984
11	Luni	1719295	1853466	5880434	6196988	2339	13198	141834	57710	434320
12	West Banas	79492	62292	62169	178588	27	64	2432	6	0
13	Sukli	39420	81198	67219	74779	38	163	3168	0	0
14	Other Nallahs of Jalore	66996	120314	114147	113596	158	202	3644	30	0
15	Ghaggar	289835	216220	277360	255298	220	990	20069	1917	188384
16	Outside Basin	2688755	2081002	6313488	7573755	2614	19218	414832	12671	885666
	Total	11534609	15070698	16705976	26945416	10795	45374	719646	454232	8056994

Note: As per Final Report No. 4.7

Table 9.3(d): Basin-wise Projected Livestock Population for year 2060

S. No.	Basin	Livestock Category								
		Cow	Buffalo	Sheep	Goat	Horse	Donkey	Camel	Pig	Poultry
1	Shekhawati	421423	1291940	736515	1721070	153	300	31526	36718	1330053
2	Ruparail	86387	703352	92119	512748	44	151	5437	28947	621659
3	Banganga	234538	1574718	223388	1045216	149	218	15419	74736	215117
4	Gambhir	110086	632924	85427	445861	63	185	7362	35347	25105
5	Parbati	70512	289431	10679	153364	8	29	847	5534	12781
6	Sabi	103425	848633	107371	572887	90	173	14038	15685	12127
7	Banas	2312761	3755246	2536875	5262195	829	1117	39998	151573	3584530
8	Chambal	1468788	2161933	290110	2425411	472	898	15649	106012	430030
9	Mahi	1566511	1331855	372151	2274326	141	993	9112	5992	1771292
10	Sabarmati	162575	119671	70272	282663	17	138	1144	112	82703
11	Luni	1689874	2210636	6666839	7255126	852	4807	149118	69612	536242
12	West Banas	78132	74296	70483	209082	10	23	2557	7	0
13	Sukli	38746	96845	76208	87547	14	59	3330	0	0
14	Other Nallahs of Jalore	65850	143499	129412	132992	57	74	3831	36	0
15	Ghaggar	284875	257886	314452	298890	80	360	21100	2312	232592
16	Outside Basin	2642744	2482020	7157806	8866976	952	6999	436136	15284	1093506
	Total	11337225	17974885	18940108	31546356	3932	16525	756604	547907	9947738

Note: As per Final Report No. 4.7

Table 9.3(e): District-wise Projected Livestock Population for year 2010

S. No.	District	Livestock Category								
		Cow	Buffalo	Sheep	Goat	Horse	Donkey	Camel	Pig	Poultry
1	Ajmer	369,327	329,002	600,451	731,509	428	1,147	3,311	25,049	1,845,373
2	Alwar	192,213	944,964	118,736	681,496	761	1,535	18,807	22,393	340,395
3	Banswara	551,452	219,741	14,524	387,965	104	1,908	1,644	295	384,524
4	Baran	334,861	230,902	14,288	243,087	141	1,142	1,283	17,508	59,251
5	Barmer	604,439	159,528	1,642,656	2,143,505	1,628	19,915	94,055	8,437	15,905
6	Bharatpur	121,307	441,977	95,247	201,942	363	1,194	5,724	31,701	95,045
7	Bhilwara	612,001	300,837	517,022	666,818	985	1,379	6,486	12,684	149,323
8	Bikaner	601,112	127,414	957,883	847,969	961	9,135	78,251	558	21,841
9	Bundi	259,752	278,787	70,234	344,100	836	1,307	3,467	10,181	43,540
10	Chittaurgarh	501,027	371,207	87,158	504,942	789	964	4,194	9,228	21,770
11	Churu	227,837	203,028	538,231	796,251	278	4,713	64,849	482	96,916
12	Dausa	135,225	398,664	72,190	327,935	323	351	7,247	14,727	16,053
13	Dhaulpur	122,823	292,756	6,813	134,854	139	300	308	4,389	6,964
14	Dungarpur	409,278	229,221	127,625	377,171	305	2,267	2,988	2,067	180,966
15	Ganganagar	619,146	270,293	451,972	357,815	979	3,400	31,007	1,380	100,658
16	Hanumangarh	403,527	312,168	339,592	258,925	827	4,575	73,836	1,657	209,969
17	Jaipur	634,234	904,194	405,557	933,516	922	731	15,165	28,328	405,499
18	Jaisalmer	326,756	2,712	1,565,332	1,088,438	708	9,806	62,505	518	21,454
19	Jalore	273,397	402,497	754,932	520,533	1,520	3,349	12,989	5,783	16,925
20	Jhalawar	411,106	295,839	16,824	357,784	907	1,143	540	10,161	67,019
21	Jhunjhunu	230,772	374,694	223,032	570,232	608	1,121	34,968	4,755	17,979
22	Jodhpur	609,567	256,696	1,171,482	1,337,341	450	4,514	40,598	2,018	17,630
23	Karauli	114,121	387,418	65,238	365,035	375	1,068	6,889	18,206	16,745
24	Kota	221,065	219,477	25,330	189,746	208	524	5,205	12,202	45,543
25	Nagaur	395,638	458,421	946,861	1,306,479	1,052	1,979	22,194	4,643	26,786
26	Pali	328,083	300,660	1,094,834	663,356	1,040	2,564	13,285	12,508	66,717
27	Pratapgarh	438,709	193,572	56,457	301,531	168	766	948	825	21,770
28	Rajsamand	281,459	218,359	150,369	487,906	747	1,457	3,987	3,055	25,738
29	Sawai Madhopur	110,161	244,371	94,674	387,228	382	809	6,105	19,132	30,447
30	Sikar	306,488	509,788	376,941	1,034,499	727	943	24,474	10,783	207,392
31	Sirohi	190,567	161,327	297,351	327,775	274	1,332	9,280	0	52,191
32	Tonk	220,723	296,508	298,422	356,986	825	293	2,127	14,686	71,795
33	Udaipur	676,509	428,325	147,963	806,019	431	1,440	6,528	908	523,999

Note: As per Final Report No. 4.6

Table 9.3(f): District-wise Projected Livestock Population for year 2020

S.No.	District	Livestock Category								
		Cow	Buffalo	Sheep	Goat	Horse	Donkey	Camel	Pig	Poultry
1	Ajmer	366,246	373,333	650,447	815,885	357	954	3,402	27,833	2,178,587
2	Alwar	190,610	1,072,292	128,622	760,104	634	1,278	19,324	25,775	401,859
3	Banswara	546,852	249,349	15,733	432,715	87	1,588	1,689	339	453,956
4	Baran	332,067	262,014	15,478	271,126	118	950	1,318	20,153	69,950
5	Barmer	599,397	181,023	1,782,680	2,390,747	1,355	16,575	96,638	9,712	18,777
6	Bharatpur	120,295	501,530	103,177	225,235	302	994	5,881	36,489	112,207
7	Bhilwara	606,896	341,373	560,071	743,732	819	1,147	6,665	14,599	176,286
8	Bikaner	590,181	144,582	1,037,640	945,778	800	7,603	80,401	642	25,785
9	Bundi	257,585	316,352	76,082	383,790	696	1,088	3,562	11,719	51,402
10	Chittaurgarh	496,847	421,225	94,415	563,185	657	802	4,309	10,621	25,701
11	Churu	225,937	230,385	583,046	888,095	231	3,922	66,630	554	114,416
12	Dausa	134,097	452,382	78,201	365,761	269	292	7,447	16,652	18,952
13	Dhaulpur	121,798	332,203	7,381	150,409	116	249	316	5,052	8,222
14	Dungarpur	405,864	260,107	138,252	420,676	254	1,887	3,070	2,379	213,643
15	Ganganagar	613,981	306,713	489,605	399,088	815	2,830	31,858	1,589	118,833
16	Hanumangarh	400,161	354,231	367,868	288,791	688	3,808	75,864	1,907	247,883
17	Jaipur	628,943	1,026,028	439,326	1,041,193	767	608	15,581	32,106	478,718
18	Jaisalmer	324,030	3,077	1,695,667	1,213,983	589	8,162	64,222	597	25,328
19	Jalore	271,117	456,731	817,790	580,574	1,265	2,787	13,346	6,657	19,981
20	Jhalawar	407,677	335,701	18,224	399,053	755	951	555	11,695	79,120
21	Jhunjhunu	232,813	420,082	241,602	636,006	506	933	35,929	5,474	21,225
22	Jodhpur	604,482	291,284	1,269,024	1,491,596	375	3,757	41,713	2,323	20,813
23	Karauli	113,169	439,620	70,670	407,140	312	889	7,078	20,956	19,768
24	Kota	219,221	249,050	27,439	211,632	173	436	5,348	14,045	53,767
25	Nagaur	392,338	520,190	1,025,701	1,457,174	876	1,647	22,804	5,344	31,623
26	Pali	325,347	341,172	1,185,994	739,871	865	2,134	13,650	14,398	78,764
27	Pratapgarh	435,049	219,655	61,157	336,312	140	638	974	949	25,701
28	Rajsamand	279,111	247,781	162,889	544,184	622	1,212	4,097	3,517	30,386
29	Sawai Madhopur	109,242	277,298	102,557	431,893	318	673	6,273	24,324	35,945
30	Sikar	305,915	587,132	408,327	1,149,823	605	784	25,146	12,411	244,840
31	Sirohi	188,977	183,065	322,109	365,582	228	1,108	9,535	0	63,615
32	Tonk	218,882	336,461	323,270	398,163	687	244	2,186	16,904	83,579
33	Udaipur	670,866	486,040	164,283	891,182	359	1,198	6,707	1,045	618,616

Note: As per Final Report No. 4.6

Table 9.3(g): District-wise Projected Livestock Population for year 2040

S. No.	District	Livestock Category								
		Cow	Buffalo	Sheep	Goat	Horse	Donkey	Camel	Pig	Poultry
1	Ajmer	360,084	461,995	751,438	983,883	218	584	3,582	36,323	2,846,603
2	Alwar	187,403	1,326,948	148,593	916,616	388	782	20,345	32,471	525,080
3	Banswara	537,651	308,567	18,176	521,815	53	972	1,778	428	593,152
4	Baran	326,480	324,240	17,881	326,953	72	582	1,388	25,388	91,399
5	Barmer	589,313	224,014	2,059,468	2,883,025	830	10,145	101,746	12,235	24,535
6	Bharatpur	118,271	620,638	119,197	271,613	185	608	6,192	45,969	146,613
7	Bhilwara	596,685	422,445	647,031	896,873	502	702	7,017	18,392	230,341
8	Bikaner	576,319	178,918	1,198,749	1,140,523	489	4,653	84,650	809	33,691
9	Bundi	253,251	391,481	87,895	462,816	426	666	3,750	14,764	67,164
10	Chittaurgarh	488,488	521,261	109,074	679,150	402	491	4,537	13,381	33,582
11	Churu	222,135	305,098	673,572	1,070,962	141	2,401	70,152	698	149,499
12	Dausa	131,841	559,817	90,342	441,074	165	179	7,840	21,356	24,763
13	Dhaulpur	119,749	411,097	8,527	181,380	71	153	333	6,365	10,742
14	Dungarpur	399,036	321,879	159,718	507,297	156	1,155	3,232	2,997	279,152
15	Ganganagar	603,651	385,553	565,624	481,264	499	1,732	33,542	2,001	155,271
16	Hanumangarh	393,428	438,356	424,985	348,255	421	2,331	79,874	2,402	323,891
17	Jaipur	618,361	1,269,697	507,538	1,255,584	469	372	16,405	41,078	625,507
18	Jaisalmer	318,579	3,808	1,958,946	1,463,954	361	4,996	67,616	752	33,094
19	Jalore	266,555	565,199	944,765	700,119	774	1,706	14,051	8,386	26,108
20	Jhalawar	400,818	415,426	21,054	481,222	462	582	584	14,734	103,381
21	Jhunjhunu	228,896	503,859	279,115	766,965	310	571	37,828	6,896	27,733
22	Jodhpur	594,312	360,461	1,466,059	1,798,730	229	2,300	43,918	2,927	27,195
23	Karauli	111,265	544,024	81,643	490,974	191	544	7,452	26,401	25,830
24	Kota	215,532	308,196	31,700	255,209	106	267	5,631	17,694	70,253
25	Nagaur	385,737	643,729	1,184,956	1,757,220	536	1,008	24,009	6,732	41,319
26	Pali	319,873	422,197	1,370,138	892,217	530	1,306	14,372	18,138	102,915
27	Pratapgarh	427,730	271,820	70,653	405,561	86	390	1,026	1,196	33,582
28	Rajsamand	274,415	306,626	188,180	656,236	381	742	4,313	4,430	39,703
29	Sawai Madhopur	107,404	343,153	118,480	520,824	194	412	6,604	27,644	46,967
30	Sikar	300,768	701,818	471,726	1,386,406	370	480	26,475	15,636	319,915
31	Sirohi	185,798	226,541	372,122	440,859	139	678	10,039	0	81,508
32	Tonk	215,200	416,366	370,462	480,148	420	149	2,301	21,296	109,206
33	Udaipur	660,579	621,468	185,170	1,074,685	220	733	7,062	1,316	808,301

Note: As per Final Report No. 4.6

Table 9.3(h): District-wise Projected Livestock Population for year 2060

S.No.	District	Livestock Category								
		Cow	Buffalo	Sheep	Goat	Horse	Donkey	Camel	Pig	Poultry
1	Ajmer	353,923	551,023	851,930	1,151,881	79	213	3,766	43,814	3,514,618
2	Alwar	184,196	1,582,656	168,464	1,073,129	141	285	21,390	39,168	648,302
3	Banswara	528,451	368,029	20,606	610,915	19	354	1,869	516	732,348
4	Baran	320,894	386,722	20,272	382,781	26	212	1,459	30,624	112,848
5	Barmer	579,228	267,183	2,334,886	3,375,303	302	3,695	106,971	14,758	30,292
6	Bharatpur	116,247	740,237	135,137	317,991	67	222	6,510	55,449	181,019
7	Bhilwara	586,475	503,852	733,560	1,050,015	183	256	7,377	22,185	284,395
8	Bikaner	566,457	213,397	1,359,061	1,335,268	178	1,695	88,997	975	41,598
9	Bundi	248,918	466,921	99,650	541,842	155	242	3,943	17,809	82,925
10	Chittaurgarh	480,129	621,710	123,661	795,115	146	179	4,770	16,140	41,463
11	Churu	218,334	340,038	763,651	1,253,829	52	874	73,755	842	184,583
12	Dausa	129,585	667,696	102,424	516,388	60	65	8,243	25,760	30,574
13	Dhaulpur	117,700	490,318	9,667	212,351	26	56	350	7,677	13,263
14	Dungarpur	392,207	383,907	181,077	593,919	57	421	3,398	3,615	344,661
15	Ganganagar	593,321	452,695	641,266	563,440	182	631	35,265	2,414	191,708
16	Hanumangarh	386,696	522,830	481,820	407,720	153	849	83,976	2,898	399,898
17	Jaipur	607,780	1,514,373	575,412	1,469,976	171	136	17,247	49,549	772,295
18	Jaisalmer	313,127	4,542	2,220,920	1,713,925	131	1,819	71,089	907	40,860
19	Jalore	261,994	674,115	1,071,111	819,665	282	621	14,773	10,115	32,235
20	Jhalawar	393,959	495,481	23,870	563,391	168	212	614	17,772	127,642
21	Jhunjhunu	224,979	599,028	316,441	891,925	113	208	39,771	7,318	34,242
22	Jodhpur	584,142	449,923	1,662,119	2,105,864	84	838	46,173	3,530	33,577
23	Karauli	109,361	648,860	92,561	574,808	70	198	7,835	30,845	31,892
24	Kota	211,844	367,587	35,939	298,786	39	97	5,920	21,343	86,739
25	Nagaur	379,136	767,778	1,343,423	2,057,266	195	367	25,242	8,120	51,016
26	Pali	314,399	503,556	1,553,370	1,044,564	193	476	15,110	21,879	127,066
27	Pratapgarh	420,410	324,201	80,102	474,811	31	142	1,079	1,443	41,463
28	Rajsamand	269,719	365,714	213,346	768,289	139	270	4,535	5,344	49,020
29	Sawai Madhopur	105,566	409,281	134,325	609,754	71	150	6,944	35,963	57,989
30	Sikar	293,621	867,062	533,811	1,628,989	135	175	27,835	18,860	394,990
31	Sirohi	182,618	270,197	421,887	516,135	51	247	10,555	0	99,400
32	Tonk	211,517	496,601	423,407	562,134	153	54	2,420	25,687	134,834
33	Udaipur	648,292	717,373	209,933	1,258,188	80	267	7,425	1,588	996,986

Note: As per Final Report No. 4.6

Table 9.3(i): State-wise Livestock Present (2010) and Projected Population

Livestock Category	Projected Population, millions			
	2010	2020	2040	2060
Cow	11.831	11.732	11.535	11.337
Buffalo	10.732	12.178	15.071	17.975
Sheep	13.349	14.461	16.706	18.940
Goat	20.034	22.344	26.945	31.546
Horse	0.021	0.018	0.011	0.004
Donkey	0.089	0.074	0.045	0.017
Camel	0.665	0.684	0.720	0.757
Pigs	0.313	0.361	0.454	0.548
Poultry	5.223	6.166	8.057	9.948

According to information from Animal Husbandry Department the daily water consumption by different animals is as follows.

	lpcd
Cows	65
Buffaloes	65
Sheep	6
Goats	5
Horses	60
Asses	60
Camels	65
Pigs	17
Ducks	3
Rabbits	0.3
Elephants	150
Poultry	0.25

On the basis of water demand per capita per day given above, the water demand for different categories of livestock has been worked out District wise and Block wise. The relation between Block and Basin / Sub-Basin has been achieved by GIS on area proportional basis, accordingly, the livestock water demand has been transferred to Basin / Sub-Basin level.

The basin wise and district wise summary of Livestock water demand for present (2010) and upto year 2060 is given in Table 9.4(a) and 9.4(b), respectively.

Table 9.4(a): Basin-wise Present (2010) and Projected Livestock Water Demand

River Basin	Water Demand, Mm^3/yr			
	2010	2020	2040	2060
Shekhawati	32.92	35.68	41.21	46.75
Ruparail	13.17	14.61	17.48	20.34
Banganga	30.46	33.65	40.01	46.42
Gambhir	12.71	14.00	16.55	19.14

River Basin	Water Demand, Mm³/yr			
	2010	2020	2040	2060
Parbati	6.11	6.67	7.81	8.95
Sabi	15.86	17.56	20.99	24.43
Banas	122.86	130.69	146.41	162.23
Chambal	71.47	75.73	84.22	92.77
Mahi	61.61	64.16	69.34	74.57
Sabarmati	6.23	6.47	6.96	7.44
Luni	96.35	102.14	113.61	125.22
West Banas	3.41	3.58	3.90	4.23
Sukli	2.64	2.84	3.24	3.64
Other Nallahs of Jalore	4.13	4.43	5.01	5.61
Ghaggar	12.11	12.64	13.67	14.73
Outside	132.71	139.14	152.01	165.15
State Total	624.75	663.99	742.41	821.62

Note: As per Final Report No. 4.7

Table 9.4(b): District-wise Present (2010) and Projected Livestock Water Demand

S. No.	District	Water Demand, Mm³/yr			
		2010	2020	2040	2060
1	Ajmer	19.75	21.06	23.64	26.26
2	Alwar	29.28	32.49	38.88	45.29
3	Banswara	19.26	19.93	21.30	22.68
4	Baran	14.14	14.87	16.37	17.86
5	Barmer	28.53	29.67	31.95	34.31
6	Bharatpur	14.38	15.88	18.84	21.84
7	Bhilwara	24.43	25.52	27.69	29.90
8	Bikaner	22.89	23.54	24.87	26.25
9	Bundi	13.82	14.76	16.62	18.51
10	Chittaurgarh	22.12	23.33	25.78	28.24
11	Churu	14.59	15.49	17.28	19.12
12	Dausa	13.77	15.12	17.83	20.54
13	Dhaulpur	10.21	11.16	13.06	14.98
14	Dungarpur	16.35	17.10	18.62	20.15
15	Ganganagar	23.72	24.62	26.43	28.29
16	Hanumangarh	20.19	21.27	23.41	25.59
17	Jaipur	39.92	42.97	49.14	55.36
18	Jaisalmer	15.02	15.49	16.41	17.39
19	Jalore	19.19	20.67	23.63	26.62
20	Jhalawar	17.67	18.63	20.53	22.44
21	Jhunjhunun	16.42	17.69	20.23	22.78
22	Jodhpur	26.77	27.99	30.40	32.86
23	Karauli	13.08	14.41	17.06	19.74
24	Kota	11.12	11.85	13.28	14.72
25	Nagaur	25.46	27.33	31.04	34.75
26	Pali	19.09	20.36	22.86	25.37
27	Pratapgarh	15.80	16.40	17.62	18.85
28	Rajsamand	13.30	14.08	15.63	17.19
29	Sawai Madhopur	9.69	10.55	12.32	14.10
30	Sikar	22.70	24.56	28.28	32.00
31	Sirohi	9.90	10.51	11.72	12.94
32	Tonk	13.81	14.86	16.98	19.09

S. No.	District	Water Demand, Mm³/yr			
		2010	2020	2040	2060
33	Udaipur	28.38	29.83	32.71	35.61
	State Total	624.75	663.99	742.41	821.62

Note: As per Final Report No. 4.6

9.4 Wildlife Water Demand

Rajasthan has two national parks - Keoladeo Ghana National Park near Bharatpur and Desert National Park near Jaisalmer, 25 Sanctuaries and 33 closed areas. To sustain and develop these national parks, sanctuaries and closed areas, and to restore the natural habitat, the relevant authorities provide water holes, eradicate and exercise grazing control in the respective areas.

The source of water, its quantity and quality are major factors affecting the Keoladeo wetland ecology. The Gambhir and Banganga river systems, at the confluence of which this national park is located, bring water to it. Water from the Gambhir is brought into the Ajan Bund through Pichuna canal, and from Banganga through Uchain canal. The amount of water supplied to this park during the 1970s and 1980s varied from a minimum of 0.017 Mm^3/yr in 1986 to a maximum of 15.32 Mm^3/yr in 1985. In most of the years it was about 14 Mm^3/yr. Rajasthan forest Department is allocated 14 Mm^3/yr of water by the Water Resources Department.

The total number of wild animals as per the 2010 census is 261,233 or 0.26 million. This number is very small in comparison with the livestock which is 56.59 million, plus some other livestock such as dogs, horse, donkeys, poultry, rabbits etc.

Thus, the number of wildlife can be taken as about 0.46% of livestock. But water is also needed by other unaccounted wildlife. Therefore, a provision of 1% of livestock water demand is considered by the Consultants as proper for a realistic assessment of water demand for wildlife.

Hence, wildlife water requirements are taken as 1% of livestock demand (in each planning stage) for the state as a whole, and this value has been distributed between the blocks in proportion to the forest areas in these blocks for the year 2010. The relation between Block and Basins / Sub-Basins has been achieved by GIS on area proportional basis, accordingly, the wildlife water demand has been transferred to Basins / Sub-Basins level as given in Table 9.5(a) and District-wise in Table 9.5(b).

Table 9.5(a): Basin-wise Present (2010) and Projected Wildlife Water Demand

River Basin	Water Demand, Mm³/yr			
	2010	2020	2040	2060
Shekhawati	0.18	0.19	0.21	0.24
Ruparail	0.23	0.24	0.27	0.30
Banganga	14.25	14.26	14.29	14.33
Gambhir	0.14	0.15	0.16	0.18
Parbati	0.12	0.12	0.14	0.15
Sabi	0.20	0.21	0.23	0.26
Banas	0.87	0.93	1.04	1.15

River Basin	Water Demand, Mm³/yr			
	2010	2020	2040	2060
Chambal	1.65	1.75	1.95	2.17
Mahi	1.15	1.22	1.37	1.51
Sabarmati	0.69	0.73	0.82	0.90
Luni	0.42	0.44	0.49	0.55
West Banas	0.17	0.18	0.20	0.22
Sukli	0.03	0.04	0.04	0.04
Other Nallahs of Jalore	0.01	0.01	0.01	0.01
Ghaggar	0.00	0.00	0.00	0.00
Outside	0.16	0.17	0.19	0.21
State Total	20.25	20.64	21.42	22.22

Note: As per Final Report No. 4.7

Table 9.5(b): District-wise Present (2010) and Projected Wildlife Water Demand

S. No.	District	Water Demand, Mm³/yr			
		2010	2010	2010	2010
1	Ajmer	0.078	0.082	0.092	0.103
2	Alwar	0.495	0.525	0.588	0.651
3	Banswara	0.254	0.271	0.302	0.335
4	Baran	0.507	0.540	0.603	0.668
5	Barmer	0.024	0.026	0.029	0.032
6	Bharatpur	14.033	14.036	14.039	14.045
7	Bhilwara	0.111	0.118	0.131	0.146
8	Bikaner	0.001	0.001	0.001	0.002
9	Bundi	0.246	0.262	0.292	0.325
10	Chittaurgarh	0.281	0.299	0.334	0.371
11	Churu	0.104	0.110	0.123	0.136
12	Dausa	0.056	0.060	0.068	0.075
13	Dhaulpur	0.132	0.141	0.157	0.174
14	Dungarpur	0.127	0.135	0.150	0.167
15	Ganganagar	0.000	0.000	0.000	0.000
16	Hanumangarh	0.004	0.005	0.005	0.006
17	Jaipur	0.199	0.213	0.238	0.266
18	Jaisalmer	0.001	0.001	0.001	0.001
19	Jalore	0.033	0.035	0.038	0.044
20	Jhalawar	0.324	0.346	0.384	0.426
21	Jhunjhunun	0.115	0.124	0.137	0.152
22	Jodhpur	0.006	0.006	0.007	0.008
23	Karauli	0.338	0.359	0.402	0.444
24	Kota	0.121	0.127	0.143	0.158
25	Nagaur	0.011	0.012	0.013	0.015
26	Pali	0.193	0.206	0.230	0.255
27	Pratapgarh	0.477	0.506	0.567	0.627
28	Rajsamand	0.122	0.129	0.145	0.161
29	Sawai Madhopur	0.216	0.229	0.257	0.284
30	Sikar	0.091	0.097	0.107	0.119
31	Sirohi	0.274	0.291	0.324	0.358
32	Tonk	0.066	0.069	0.078	0.087
33	Udaipur	1.210	1.279	1.435	1.579
	State Total	20.250	20.640	21.420	22.220

Note: As per Final Report No. 4.6

9.5 Power Station's Cooling Water Demand

Rajasthan does not have any large potential for hydroelectric power development, and has to depend for its future requirements of hydro-power on other States, and to a large extent on thermal and nuclear power plants to be installed within the State. Rajasthan has large resources of lignite, and many lignite-based power projects have already been planned and more can be planned for its future needs. With the gas finds at several places, including Rajasthan, the potential of gas-based thermal power station has also increased. With increase in the thermal power generation water requirements for cooling of station would increase correspondingly.

On an average, the consumptive water requirements of conventional thermal power station (TPS) amount to between 2.5 and 4.5 Mm3/yr per 100 MW for different types and sizes of plants. For super TPPs at Suratgarh and Kota the demand has been estimated as 7.15 Mm3/yr per 100 MW. For gas based TPP the water requirement remains between 2.5 to 5.6 Mm3/yr per 100 MW. In case of Giral TPP the water demand remains between 4.3 to 6.5 Mm3/yr per 100 MW. Nuclear power station require much larger quantities of cooling water for the condenser and other auxiliaries, as well as for the heat transport system between the reactor and the steam generator, but the consumptive use of water is lower than that of conventional thermal power station. The consumptive use of water in nuclear power stations is about 3 Mm^3/yr, or 0.1 m^3/sec per 100 MW.

The State owned power generation plants with their installed capacities and water requirement are shown in Table 9.6. The installed capacities of existing projects run by the agencies other than Rajasthan Vidhyut Utpadan Nigam Limited (RVUNL) and their respective installed capacities and water requirements have been shown in Table 9.7. (The water demand for power generation is consumptive use demand only)

Table 9.6: State Owned (RVUNL) Power Generation Plants Up to 2010

District	Block	Name of Power Plant	Installed Capacity, MW	Water Demand, Mm^3/yr
Banswara	Bagidora	Mahi Hydel Project	140.000	12.60
	Ghatol	RMC-I, Mahi (Hydel)	0.800	0.04
	Ghatol	RMC-II, Mahi (Hydel)	0.165	0.01
Baran	Anta	Mangrol Hydel Project	6.000	0.27
	Chhabra	Chhabra TPP, Stage I, Phase I (Unit 1 &2)	500.000	14.16
Barmer	Sheo	Giral Lignite TPS Unit 1&2	250.000	10.72
Bikaner	Khajuwala	Pugal Mini Hydel Project - I	1.500	0.07
	Khajuwala	Pugal Mini Hydel Project - II	0.650	0.03
	Kolayat	Birsalpur Hydel Power House	0.535	0.02
	Kolayat	Charanwala Hydel Station	1.200	0.05
Dhaulpur	Dhaulpur	Dhaulpur Gas Combined Cycle, Stage-I	330.000	17.86
Ganganagar	Suratgarh	Anoopgarh Hydel Station, Anoopgarh	9.000	0.41
	Suratgarh	Suratgarh Super TPS Stage I to IV (Unit-1 to 6)	1500.000	107.16
Hanumangarh	Hanumangarh	Suratgarh Mini Hydel Power House, Lakhuwali	4.000	0.18

District	Block	Name of Power Plant	Installed Capacity, MW	Water Demand, Mm^3/yr
Jaisalmer	Sam	Ramgarh Gas TPS	35.500	1.55
	Sam	Ramgarh Gas TPS (Extn.)	75.000	3.27
Kota	Ladpura	Kota Super TPS Stage I to V (Unit 1 to 7)	1240.000	88.66
		Total	4094.350	257.06

Source: Rajasthan Rajya Vidyut Prasaran Nigam Limited (RRVPNL), Jaipur
Note: For details refer Final Report No. 4.6

Table 9.7: Other Than State Owned Power Generation Plants Up to 2010

District	Block	Name of Power Plant	Installed Capacity, MW	Water Demand, Mm^3/yr
Baran	Anta	Anta GPS	413.000	23.13
Bikaner	Bikaner	Palana Lignite	120.000	7.80
	Bikaner	Barsinghsar Lignite by NTPC	240.000	15.60
Chittaurgarh	Bhainsrorgarh	RAPP (Nuclear) Unit 1 to 6	1180.000	52.31
	Chittaurgarh	Chittaurgarh TPS	220.000	9.90
Jodhpur	Osian	Solar Thermal, Matharia	30.000	1.42
		Total	2203.000	110.16

Source: - Tahal-WAPCOS Study, 1998 and Private Sector Projects
Note: For details refer Final Report No. 4.6

No projections of Power demand or installed capacities of Nuclear power plants is available. However information has been collected for the thermal power plants (Coal based, Gas based and Giral TPP) from RVUNL to be installed between the year 2011 to 2020 and after the year 2020.

Further programme of installation of Power Plants is not available. Therefore the consultants have considered the sources of water, where the power plants can be proposed to be installed by 2040 and 2060. It has been assumed that expansion of power generation will be mainly on three sources of water viz. IGNP, Chambal and Mahi.

Increase in water demand from 2020 to 2030 is estimated as 35.4%. Hence, the same factor has been applied to arrive at the increase in demand from 2030 to 2040 only on the demand of areas where expansion can be expected considering the three sources of water mentioned above. Based on this, the increase in water demand from 2020 to 2040 is estimated as 67.8% which has been applied to arrive at the increase in demand from 2040 to 2060 only on the demand of areas where further expansion can be expected considering the three sources of water mentioned above.

The cooling water requirement for power sector has been assessed for specific locations where power plants exist. The location of power plants in terms of Basins / Sub-Basins has been achieved by GIS, accordingly, the power station's cooling water demand has been duly transferred on its location in Basins / Sub-Basins as presented in Table 9.8(a) and District-wise in Table 9.8(b).

Table 9.8(a): Basin-wise Present (2010) and Projected Water Demand for Power Stations

River Basin	Consumptive Water Requirement in Mm³/year			
	2010	2020	2040	2060
Shekhawati	-	-	-	-
Ruparail	-	-	-	-
Banganga	-	-	-	-
Gambhir	-	-	-	-
Parbati	17.86	26.79	29.95	38.15
Sabi	-	-	-	-
Banas	9.90	9.90	38.25	38.25
Chambal	178.26	432.81	627.08	788.82
Mahi	0.05	113.33	153.43	257.43
Sabarmati	-	-	-	-
Luni	12.14	86.33	156.12	253.73
West Banas	-	-	-	-
Sukli	-	-	-	-
Other Nallahs of Jalore	-	-	-	-
Ghaggar	-	-	-	-
Outside	135.38	228.00	260.78	345.80
State Total	353.59	897.16	1,265.61	1,722.18

Note: As per Final Report No. 4.7

Table 9.8(b): District-wise Present (2010) and Projected Water Demand for Power Stations

S. No.	District	Consumptive Water Requirement in Mm³/year			
		2010	2020	2040	2060
1	Ajmer	-	-	-	-
2	Alwar	-	-	-	-
3	Banswara	0.05	113.33	153.43	257.43
4	Baran	37.29	138.81	255.81	309.79
5	Barmer	10.72	84.91	154.7	252.31
6	Bharatpur	-	-	-	-
7	Bhilwara	-	-	28.35	28.35
8	Bikaner	23.4	23.4	23.4	23.4
9	Bundi	-	-	36.27	60.86
10	Chittaurgarh	62.21	143.88	172.79	247.76
11	Churu	-	-	-	-
12	Dausa	-	-	-	-
13	Dhaulpur	17.86	26.79	29.95	38.15
14	Dungarpur	-	-	-	-
15	Ganganagar	107.16	181.92	208.38	277
16	Hanumangarh	-	-	-	-
17	Jaipur	-	-	-	-
18	Jaisalmer	4.82	22.68	29	45.4
19	Jalore	-	-	-	-
20	Jhalawar	-	71.36	71.36	71.36
21	Jhunjhunu	-	-	-	-
22	Jodhpur	1.42	1.42	1.42	1.42
23	Karauli	-	-	-	-
24	Kota	88.66	88.66	100.75	108.95
25	Nagaur	-	-	-	-

S. No.	District	Consumptive Water Requirement in Mm³/year			
		2010	2020	2040	2060
26	Pali	-	-	-	-
27	Pratapgarh	-	-	-	-
28	Rajsamand	-	-	-	-
29	Sawai Madhopur	-	-	-	-
30	Sikar	-	-	-	-
31	Sirohi	-	-	-	-
32	Tonk	-	-	-	-
33	Udaipur	-	-	-	-
	Total	353.59	897.16	1,265.61	1,722.18

Note: As per Final Report No. 4.6

9.6 Industrial Water Demand

The Rajasthan State Industrial Development and Investment Corporation (RIICO) have assessed industrial water demand on the basis of industrial area developed. The present industrial water requirements have been estimated at 4.54 m3 per acre per day (i.e. 11.22 m3 per ha per day) of industrial area developed.

The block-wise distribution of the industrial areas was taken from the district Industrial Profile reports prepared by MSME-Development Institute under Ministry of MSME (Micro, Small and Medium and Enterprises), Govt. of India. On the basis of norms of RIICO, the industrial water demand for industries in RIICO area scattered in various blocks of Rajasthan has been worked out. Besides it, there are many industries outside the RIICO area at various locations. For the industries outside RIICO area it has been assumed that their requirement would be 20% of the water demand of the RIICO area. Besides it, at some, locations, there are industries having more than 20% industrial area and having more water demand than that of RIICO area. Such information collected from industry department and from WRD reports of 2009, have been incorporated while working out water demand outside RIICO area (The water requirement for industries are consumptive requirement only).

The projections have been made for the year 2020, 2040 and 2060. It is anticipated that, due to globalization there would be rapid expansion of industries which will result increase in water demand also. It has been estimated that there would be 25% more water demand in the next decade. Hence while projecting water demand 25% increase per decade has been considered. The future projections of water demand for industries district-wise and block-wise have been worked out.

Since, the water requirement for industrial sector has been calculated on specific locations where clusters of industries exist. The location of the industrial units (cluster) in terms of Basins / Sub-Basins has been achieved by GIS, accordingly, the industrial water demand has been transferred by its location in Basins / Sub-Basins as presented in Table 9.9(a) and District-wise in Table 9.9(b).

Table 9.9(a): Basin-wise Present (2010) and Projected Industrial Water Demand

River Basin	Water Demand, Mm^3/yr			
	2010	2020	2040	2060
Shekhawati	18.92	23.67	37.00	57.82
Ruparail	7.12	8.91	13.92	21.75
Banganga	2.48	3.12	4.88	7.62
Gambhir	2.91	3.65	5.70	8.91
Parbati	1.84	2.30	3.59	5.61
Sabi	11.48	14.36	22.44	35.07
Banas	134.96	170.85	266.93	417.09
Chambal	42.78	53.51	83.60	130.65
Mahi	21.02	28.64	44.75	69.93
Sabarmati	1.35	1.87	2.92	4.57
Luni	26.91	33.68	52.63	82.23
West Banas	3.85	4.81	7.51	11.74
Sukli	0.22	0.28	0.44	0.68
Other Nallahs of Jalore	0.08	0.11	0.17	0.26
Ghaggar	0.91	1.14	1.78	2.79
Outside	20.30	25.39	39.65	61.93
State Total	297.13	376.28	587.92	918.66

Note: As per Final Report No. 4.7

Table 9.9(b): District-wise Present (2010) and Projected Industrial Water Demand

S. No.	District	Water Demand, Mm^3/yr			
		2010	2020	2040	2060
1	Ajmer	5.32	6.65	10.40	16.25
2	Alwar	25.21	31.53	49.28	77.01
3	Banswara	7.87	9.84	15.38	24.04
4	Baran	0.36	0.46	0.72	1.13
5	Barmer	11.29	14.11	22.05	34.46
6	Bharatpur	1.14	1.43	2.24	3.50
7	Bhilwara	8.56	10.71	16.73	26.14
8	Bikaner	5.92	7.41	11.58	18.09
9	Bundi	0.41	0.51	0.79	1.24
10	Chittaurgarh	26.94	34.97	54.64	85.38
11	Churu	1.97	2.47	3.86	6.02
12	Dausa	0.88	1.11	1.73	2.70
13	Dhaulpur	4.55	5.69	8.89	13.90
14	Dungarpur	2.13	2.67	4.17	6.52
15	Ganganagar	6.62	8.27	12.92	20.19
16	Hanumangarh	1.32	1.65	2.57	4.01
17	Jaipur	90.84	113.56	177.44	277.25
18	Jaisalmer	0.48	0.60	0.93	1.45
19	Jalore	0.78	0.98	1.52	2.37
20	Jhalawar	1.37	1.71	2.67	4.18
21	Jhunjhunu	8.47	10.59	16.54	25.85
22	Jodhpur	6.70	8.38	13.08	20.44
23	Karauli	0.65	0.82	1.28	2.00
24	Kota	32.94	41.19	64.36	100.57
25	Nagaur	2.75	3.45	5.40	8.42
26	Pali	4.67	5.86	9.16	14.31

S. No.	District	Water Demand, Mm³/yr			
		2010	2020	2040	2060
27	Pratapgarh	0.10	0.13	0.20	0.31
28	Rajsamand	9.00	11.25	17.58	27.47
29	Sawai Madhopur	0.85	1.06	1.65	2.58
30	Sikar	2.41	3.03	4.74	7.41
31	Sirohi	6.27	7.84	12.26	19.16
32	Tonk	1.52	1.90	2.96	4.63
33	Udaipur	16.84	24.45	38.20	59.68
	Total	297.13	376.28	587.92	918.66

Note: As per Final Report No. 4.6

9.7 Summary

Total projected non-agricultural water demands are summarized in Table 9.10 below.

Table 9.10: Basin-wise Summary of Non-Agricultural Water Demands, Mm³/yr

River Basin	Planning Stage, Year	Non-Agricultural Water Demands, Mm³/yr					
		Domestic (including Institutional)	Livestock	Wildlife	Power	Industrial	Total
Shekhawati	2010	106.40	32.92	0.18	0.00	18.92	158.42
	2020	164.24	35.68	0.19	0.00	23.67	223.78
	2040	204.46	41.21	0.21	0.00	37.00	282.88
	2060	230.18	46.75	0.24	0.00	57.82	334.98
Ruparail	2010	61.93	13.17	0.23	0.00	7.12	82.44
	2020	99.98	14.61	0.24	0.00	8.91	123.73
	2040	141.23	17.48	0.27	0.00	13.92	172.90
	2060	165.50	20.34	0.30	0.00	21.75	207.90
Banganga	2010	99.84	30.46	14.25	0.00	2.48	147.03
	2020	170.23	33.65	14.26	0.00	3.12	221.26
	2040	218.81	40.01	14.29	0.00	4.88	277.99
	2060	251.24	46.42	14.33	0.00	7.62	319.60
Gambhir	2010	46.61	12.71	0.14	0.00	2.91	62.36
	2020	78.85	14.00	0.15	0.00	3.65	96.64
	2040	100.31	16.55	0.16	0.00	5.70	122.72
	2060	114.80	19.14	0.18	0.00	8.91	143.03
Parbati	2010	14.19	6.11	0.12	17.86	1.84	40.12
	2020	25.23	6.67	0.12	26.79	2.30	61.11
	2040	32.90	7.81	0.14	29.95	3.59	74.38
	2060	37.84	8.95	0.15	38.15	5.61	90.70
Sabi	2010	54.43	15.86	0.20	0.00	11.48	81.96
	2020	92.12	17.56	0.21	0.00	14.36	124.25
	2040	121.34	20.99	0.23	0.00	22.44	165.00
	2060	140.42	24.43	0.26	0.00	35.07	200.18
Banas	2010	573.17	122.86	0.87	9.90	134.96	841.77
	2020	871.22	130.69	0.93	9.90	170.85	1,183.59
	2040	1,150.20	146.41	1.04	38.25	266.93	1,602.83
	2060	1,331.40	162.23	1.15	38.25	417.09	1,950.11
Chambal	2010	233.26	71.47	1.65	178.26	42.78	527.43

River Basin	Planning Stage, Year	Non-Agricultural Water Demands, Mm³/yr					
		Domestic (including Institutional)	Livestock	Wildlife	Power	Industrial	Total
	2020	368.68	75.73	1.75	432.81	53.51	932.48
	2040	485.63	84.22	1.95	627.08	83.60	1,282.48
	2060	561.68	92.77	2.17	788.82	130.65	1,576.09
Mahi	2010	103.18	61.61	1.15	0.05	21.02	187.00
	2020	196.31	64.16	1.22	113.33	28.64	403.66
	2040	256.83	69.34	1.37	153.43	44.75	525.72
	2060	296.00	74.57	1.51	257.43	69.93	699.44
Sabarmati	2010	14.83	6.23	0.69	0.00	1.35	23.10
	2020	30.11	6.47	0.73	0.00	1.87	39.18
	2040	39.11	6.96	0.82	0.00	2.92	49.82
	2060	44.49	7.44	0.90	0.00	4.57	57.40
Luni	2010	465.53	96.35	0.42	12.14	26.91	601.35
	2020	707.01	102.14	0.44	86.33	33.68	929.60
	2040	921.42	113.61	0.49	156.12	52.63	1,244.28
	2060	1,063.97	125.22	0.55	253.73	82.23	1,525.69
West Banas	2010	14.57	3.41	0.17	0.00	3.85	22.00
	2020	22.78	3.58	0.18	0.00	4.81	31.34
	2040	30.73	3.90	0.20	0.00	7.51	42.34
	2060	35.77	4.23	0.22	0.00	11.74	51.97
Sukli	2010	3.72	2.64	0.03	0.00	0.22	6.62
	2020	7.24	2.84	0.04	0.00	0.28	10.38
	2040	9.04	3.24	0.04	0.00	0.44	12.76
	2060	10.16	3.64	0.04	0.00	0.68	14.53
Other Nallahs of Jalore	2010	11.31	4.13	0.01	0.00	0.08	15.53
	2020	18.84	4.43	0.01	0.00	0.11	23.39
	2040	25.04	5.01	0.01	0.00	0.17	30.23
	2060	29.15	5.61	0.01	0.00	0.26	35.03
Ghaggar	2010	35.72	12.11	0.00	0.00	0.91	48.74
	2020	50.59	12.64	0.00	0.00	1.14	64.37
	2040	59.21	13.67	0.00	0.00	1.78	74.67
	2060	66.23	14.73	0.00	0.00	2.79	83.75
Outside	2010	518.94	132.71	0.16	135.38	20.30	807.49
	2020	767.93	139.14	0.17	228.00	25.39	1,160.63
	2040	966.05	152.01	0.19	260.78	39.65	1,418.68
	2060	1,098.99	165.15	0.21	345.80	61.93	1,672.07
Grand Total	2010	2,357.64	624.75	20.25	353.59	297.13	3,653.36
	2020	3,671.33	663.99	20.64	897.16	376.28	5,629.40
	2040	4,762.32	742.41	21.42	1,265.61	587.92	7,379.68
	2060	5,477.81	821.62	22.22	1,722.18	918.66	8,962.49

Note: As per Final Report No. 4.7

10. Crop Water Requirement

Crop water requirement has been defined as "the depth of water needed to meet the water losses through evapotranspiration (ET crop) of a disease-free crop, growing in large fields under non-restricting soil conditions, including soil water and fertility and achieving full production potential under the given growing environment".

Assessing crop water requirements accurately on the basis of field measurements is time-consuming and costly. Therefore, certain computational methods have been developed and tested, with a view to obtain results that can be applied at short notice for project planning. Out of several methods, the modified Penman method was adopted by the Food and Agriculture Organization (FAO) of the United Nations in 1977 and published as Irrigation and Drainage Paper No. 24 - "Crop Water Requirements".

10.1 The Modified Penman Method

The form of the equation used in the modified Penman method is:

$$ETo = C\,[W.Rn+(1-W).f(u).(ea-ed)],$$

Where,

ETo	=	reference crop evapotranspiration in mm/day
W	=	temperature-related weighing factor
Rn	=	net radiation in equivalent evapotranspiration in mm/day.
f(u)	=	wind related functions
(ea – ed)	=	difference between the saturation vapour pressure at mean air temperature and the mean actual vapour pressure of the air, both in mbar
C	=	adjustment factor to compensate for the effect of day and night weather conditions.

Due to the interdependence of the variables composing the equation, the correct use of units in all variables is important.

10.2 Net Crop Water Requirement

Computation of net crop water requirements was aimed at a full meeting of crop water deficits in order to realise the yield potential of crops after considering the effective rainfall and available soil moisture. The computational procedure involves simulation of the water balance within the effective root zone of the crop on a monthly basis.

10.3 Net Irrigation Demand

Using the net crop water requirement for major crops in each District at various dependability levels and the crop-basket (Rabi + Kharif) as per the prevailing pattern in the irrigated areas, the weighted average net irrigation demands for each district has been estimated in mm as shown in Table 10.1. These values when

multiplied with 10 gives the net irrigation water demand in m^3/ha. This aspect has been presented in detail in Final Report No. 4.6.

The project-wise (surface-water-irrigated projects) total net irrigation demand (in Mm^3) at various dependability were arrived at by using the data in hectares on Culturable Command Area (CCA) of these projects collected from Water Resources Department, Govt. of Rajasthan and the estimated net irrigation water requirement in m^3/ha.

For the areas outside the CCA of surface-water-irrigated projects the net irrigation demand has been estimated block-wise at various dependability levels by using the data in hectares on potential irrigable areas and the estimated net irrigation water requirement in m^3/ha.

Gross irrigation water demands have been computed by applying the factors of on-farm and off-farm irrigation efficiency to the net irrigation water demand for individual surface-water-irrigated projects and areas outside the CCA of surface-water-irrigated projects in each block, considering the type of water source. The data related to on-farm and off-farm efficiency for present situation has been taken as per existing condition of projects, while for future improved efficiency figures resulting from implementation of suggested rehabilitation and upgrading measures have been considered.

Table 10.1: District-wise weighted net crop water requirement (in mm)

Dependability Levels	Weighted Net Crop Water Requirement, mm												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
District:	**Ajmer**												
25%	70.1	60.5	24.9	8.9	11.0	13.8	13.3	14.7	14.7	14.3	26.6	54.7	327.5
50%	70.4	60.8	25.0	9.0	12.7	16.2	15.6	17.3	17.3	16.1	27.0	55.2	342.6
75%	71.0	61.3	25.2	9.1	15.5	20.4	20.1	22.4	22.8	19.5	27.7	56.2	371.2
90%	71.3	61.5	25.3	9.1	17.5	23.3	23.1	25.8	26.3	21.8	28.2	56.7	389.9
District:	**Alwar**												
25%	78.4	60.2	17.5	2.7	1.6	0.6	1.0	1.4	1.6	24.5	46.0	54.7	290.2
50%	78.7	60.3	17.6	2.7	1.6	0.7	1.2	1.7	2.0	24.9	46.3	54.9	292.6
75%	79.2	60.7	17.7	2.7	1.8	0.9	1.6	2.4	2.9	25.6	46.7	55.3	297.5
90%	79.6	61.1	17.8	2.7	2.0	1.2	2.1	3.1	3.6	26.1	46.9	55.6	301.8
District:	**Banswara**												
25%	107.8	101.8	35.8	0.2	0.1	0.0	0.0	0.0	0.0	0.0	25.7	80.0	351.4
50%	108.1	102.0	35.9	0.2	0.1	0.0	0.0	0.0	0.0	0.0	25.7	80.2	352.2
75%	108.7	102.6	36.1	0.2	0.1	0.1	0.0	0.0	0.0	0.0	25.9	80.6	354.3
90%	109.0	102.9	36.2	0.2	0.1	0.1	0.0	0.0	0.0	0.0	25.9	80.9	355.3
District:	**Baran**												
25%	75.8	52.2	14.5	0.3	0.1	0.0	3.7	3.3	3.6	34.4	61.8	74.4	324.1
50%	76.1	52.4	14.5	0.3	0.1	0.0	3.9	3.5	3.8	34.8	62.1	74.7	326.2
75%	76.6	52.7	14.6	0.3	0.1	0.0	4.3	3.9	4.3	35.5	62.6	75.3	330.2
90%	76.8	52.8	14.6	0.3	0.1	0.1	4.6	4.2	4.6	35.8	62.9	75.5	332.3
District:	**Barmer**												
25%	77.9	25.3	2.6	0.1	0.1	0.1	1.6	2.8	3.8	5.0	47.1	76.9	243.3
50%	78.5	25.5	2.6	0.1	0.1	0.1	2.1	3.9	5.2	5.5	47.5	77.5	248.6
75%	78.8	25.6	2.6	0.1	0.1	0.1	3.5	6.3	8.4	6.7	47.7	77.8	257.7
90%	78.8	25.7	2.7	0.1	0.1	0.1	4.2	7.7	10.2	7.4	47.8	77.9	262.7

Dependability Levels	Weighted Net Crop Water Requirement, mm												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
District:	**Bharatpur**												
25%	67.5	51.7	13.9	0.4	0.4	0.3	0.9	0.8	0.9	20.2	38.4	47.6	243.0
50%	70.1	54.0	14.7	0.5	0.4	0.4	1.0	0.8	0.9	20.4	39.3	49.6	252.1
75%	77.4	60.7	16.9	0.5	0.4	0.4	1.1	0.9	1.1	20.7	41.1	55.0	276.2
90%	76.5	59.8	16.6	0.5	0.5	0.4	1.1	1.0	1.1	20.9	41.1	54.2	273.7
District:	**Bhilwara**												
25%	84.6	75.0	25.4	1.9	7.1	9.5	9.1	9.6	8.7	12.6	29.5	63.2	336.2
50%	84.9	75.2	25.5	1.9	8.1	11.0	10.4	11.0	9.9	13.5	29.7	63.5	344.6
75%	85.5	75.7	25.7	2.0	10.0	13.7	13.0	13.9	12.6	15.3	30.0	64.0	361.4
90%	85.7	76.0	25.9	2.1	11.3	15.5	14.8	15.8	14.4	16.5	30.2	64.3	372.5
District:	**Bikaner**												
25%	36.5	35.5	14.1	0.0	0.9	1.4	13.3	17.8	23.8	15.1	18.6	26.6	203.6
50%	36.7	35.7	14.2	0.0	1.1	1.6	17.1	22.9	30.7	18.4	18.8	26.7	223.9
75%	36.9	35.9	14.3	0.0	1.4	2.0	24.0	32.1	43.1	24.3	18.9	26.9	259.8
90%	37.0	36.1	14.3	0.0	1.6	2.3	28.7	38.5	51.7	28.4	19.0	27.0	284.6
District:	**Bundi**												
25%	83.1	71.2	22.6	0.4	0.1	0.1	26.0	23.3	25.4	35.1	34.7	61.6	383.6
50%	83.4	71.4	22.7	0.4	0.1	0.1	27.6	24.7	27.0	36.7	35.0	61.8	390.9
75%	83.8	71.8	22.8	0.4	0.1	0.1	30.6	27.7	30.2	39.5	35.4	62.2	404.6
90%	84.0	72.0	22.9	0.4	0.1	0.1	32.6	29.6	32.3	41.3	35.7	62.3	413.3
District:	**Chittaurgarh**												
25%	90.1	73.8	22.3	0.6	2.2	2.9	3.2	3.2	2.9	18.5	41.7	66.5	327.9
50%	90.5	74.1	22.4	0.6	2.5	3.4	3.6	3.7	3.3	19.0	42.0	66.7	331.8
75%	91.0	74.6	22.6	0.6	3.1	4.2	4.4	4.5	4.0	19.6	42.3	67.2	338.1
90%	91.3	74.8	22.6	0.6	3.5	4.8	5.0	5.1	4.5	20.1	42.5	67.4	342.2
District:	**Churu**												
25%	46.0	40.6	14.2	0.0	0.0	0.0	10.6	14.3	20.1	15.0	22.9	34.2	217.9
50%	46.2	40.8	14.3	0.0	0.0	0.0	13.8	18.7	26.3	17.8	23.1	34.4	235.4
75%	46.5	41.0	14.4	0.0	0.0	0.0	19.7	26.8	37.7	22.9	23.2	34.6	266.8
90%	46.6	41.2	14.4	0.0	0.0	0.0	23.7	32.3	45.4	26.3	23.3	34.8	288.0
District:	**Dausa**												
25%	74.2	60.6	17.9	0.6	0.2	0.2	1.4	1.8	2.5	16.4	35.6	53.3	264.7
50%	74.5	60.8	18.0	0.6	0.2	0.2	1.8	2.3	3.2	16.9	35.8	53.6	267.9
75%	74.9	61.1	18.0	0.6	0.2	0.2	2.5	3.2	4.4	17.6	36.1	53.8	272.6
90%	75.2	61.3	18.1	0.6	0.2	0.2	2.9	3.8	5.3	18.1	36.2	54.0	275.9
District:	**Dhaulpur**												
25%	78.2	62.4	17.9	0.3	0.3	0.2	0.2	0.1	0.2	18.3	39.4	55.7	273.2
50%	78.6	62.7	17.9	0.4	0.3	0.3	0.2	0.1	0.2	18.5	39.8	56.0	275.0
75%	79.1	63.2	18.1	0.4	0.3	0.3	0.2	0.1	0.3	18.8	40.1	56.4	277.3
90%	79.4	63.4	18.1	0.4	0.3	0.3	0.2	0.1	0.3	18.9	40.3	56.6	278.3
District:	**Dungarpur**												
25%	110.3	103.3	35.9	0.4	0.3	0.3	0.3	0.2	0.2	0.5	25.8	81.8	359.3
50%	110.6	103.5	36.0	0.4	0.3	0.4	0.3	0.3	0.2	0.5	25.8	82.0	360.3
75%	111.2	104.1	36.3	0.4	0.4	0.4	0.3	0.3	0.3	0.6	26.0	82.4	362.7
90%	111.5	104.4	36.4	0.4	0.4	0.5	0.4	0.4	0.3	0.6	26.0	82.7	364.0
District:	**Ganganagar**												
25%	45.3	36.6	11.6	1.6	14.6	20.3	21.4	23.6	21.0	25.4	25.2	32.5	279.1
50%	45.6	36.8	11.7	1.6	16.9	23.6	25.1	27.9	24.9	28.0	25.4	32.7	300.2
75%	45.9	37.0	11.8	1.7	21.0	29.5	32.2	36.3	32.4	32.5	25.6	32.9	338.8
90%	46.0	37.1	11.9	1.8	23.9	33.7	37.0	41.9	37.5	35.6	25.7	33.0	365.1

Dependability Levels	Weighted Net Crop Water Requirement, mm												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
District:	**Hanumangarh**												
25%	45.0	39.2	12.8	0.3	16.9	24.6	28.9	30.8	27.7	26.0	18.4	32.8	303.4
50%	45.2	39.4	12.8	0.3	19.9	28.9	33.6	36.0	32.4	29.2	18.6	32.9	329.2
75%	45.4	39.6	12.9	0.4	25.0	36.4	41.9	45.5	41.0	34.8	18.7	33.1	374.7
90%	45.6	39.7	12.9	0.4	28.6	41.7	47.7	52.1	46.9	38.8	18.8	33.2	406.4
District:	**Jaipur**												
25%	80.5	70.4	24.7	4.9	0.3	0.1	3.5	5.1	7.1	13.9	33.3	59.4	303.2
50%	80.8	70.7	24.8	4.9	0.3	0.1	4.6	6.6	9.2	14.9	33.6	59.6	310.1
75%	81.3	71.2	24.9	5.0	0.4	0.1	6.7	9.7	13.5	16.8	33.8	60.1	323.5
90%	81.6	71.4	25.0	5.0	0.4	0.1	8.0	11.8	16.3	18.1	34.0	60.3	332.0
District:	**Jaisalmer**												
25%	59.3	38.7	12.0	0.0	0.1	0.1	4.6	6.8	8.7	14.8	41.5	49.4	236.0
50%	59.7	38.9	12.1	0.0	0.1	0.1	5.9	8.8	11.3	16.1	41.8	49.8	244.6
75%	60.1	39.3	12.2	0.0	0.1	0.1	8.7	13.0	16.6	18.3	42.1	50.1	260.6
90%	60.3	39.4	12.2	0.0	0.1	0.1	10.5	15.7	20.0	19.8	42.3	50.3	270.7
District:	**Jalore**												
25%	89.7	37.8	6.1	0.6	0.3	0.3	1.2	1.9	2.5	16.1	57.3	79.3	293.1
50%	90.2	38.0	6.1	0.6	0.3	0.3	1.6	2.5	3.3	16.5	57.7	79.7	296.8
75%	90.6	38.3	6.2	0.6	0.3	0.4	2.4	3.8	5.0	17.3	58.0	80.1	303.0
90%	90.8	38.4	6.2	0.6	0.4	0.5	2.8	4.6	6.1	17.8	58.1	80.3	306.6
District:	**Jhalawar**												
25%	66.4	45.1	19.6	7.5	8.4	7.0	5.8	4.5	4.8	34.6	66.2	83.4	353.3
50%	66.6	45.3	19.8	7.7	8.7	7.3	6.0	4.8	5.0	34.9	66.5	83.7	356.3
75%	67.1	45.7	20.3	8.2	9.3	7.8	6.5	5.1	5.4	35.6	67.2	84.6	362.8
90%	67.3	45.9	20.6	8.6	9.7	8.1	6.8	5.4	5.7	35.9	67.5	84.9	366.4
District:	**Jhunjhunu**												
25%	59.2	51.2	17.2	0.8	0.4	0.0	2.1	3.8	5.0	13.8	31.3	42.3	227.1
50%	59.5	51.5	17.3	0.8	0.4	0.0	2.8	5.0	6.7	14.6	31.5	42.5	232.6
75%	59.9	51.7	17.4	0.8	0.4	0.0	4.5	8.0	10.7	16.1	31.8	42.8	244.1
90%	60.1	52.0	17.5	0.8	0.4	0.0	5.4	9.7	12.9	17.0	32.0	43.0	250.8
District:	**Jodhpur**												
25%	50.1	29.4	10.8	5.9	4.9	3.0	10.7	14.8	19.2	18.6	30.0	40.7	238.1
50%	50.4	29.6	10.8	5.9	5.3	3.6	13.8	19.1	25.0	21.2	30.3	41.0	256.0
75%	50.7	29.7	10.8	5.9	6.0	4.5	19.7	27.8	36.5	26.3	30.6	41.4	289.9
90%	50.8	29.9	10.9	5.9	6.4	5.1	23.6	33.4	44.0	29.6	30.8	41.6	312.0
District:	**Karauli**												
25%	80.8	66.7	20.1	0.6	0.3	0.3	0.2	0.2	0.3	15.6	36.6	58.0	279.7
50%	81.2	67.0	20.2	0.7	0.3	0.3	0.2	0.2	0.3	15.7	36.9	58.3	281.3
75%	81.8	67.4	20.3	0.7	0.4	0.3	0.3	0.3	0.4	15.9	37.2	58.7	283.7
90%	82.1	67.6	20.4	0.7	0.4	0.4	0.3	0.3	0.4	16.0	37.4	58.9	284.9
District:	**Kota**												
25%	76.6	55.6	16.1	0.5	0.2	0.1	10.2	9.0	9.8	36.1	55.8	70.8	340.8
50%	76.9	55.8	16.2	0.5	0.2	0.2	10.8	9.5	10.4	36.8	56.2	71.1	344.6
75%	77.4	56.1	16.2	0.5	0.2	0.2	11.9	10.5	11.4	38.1	56.7	71.6	350.8
90%	77.6	56.3	16.3	0.5	0.2	0.2	12.6	11.1	12.1	38.9	57.0	71.8	354.6
District:	**Nagaur**												
25%	58.4	39.3	12.7	3.0	5.0	5.2	8.7	11.9	13.4	12.7	30.2	48.9	249.4
50%	58.8	39.5	12.8	3.0	5.6	6.1	10.9	15.1	17.3	14.5	30.5	49.3	263.4
75%	59.1	39.7	12.8	3.0	6.7	7.7	15.5	22.1	25.8	18.1	30.6	49.5	290.6
90%	59.2	39.8	12.8	3.0	7.5	8.8	18.5	26.4	31.0	20.3	30.7	49.6	307.6

Dependability Levels	Weighted Net Crop Water Requirement, mm												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
District:	**Pali**												
25%	88.5	68.8	21.3	1.2	4.7	6.2	5.7	6.3	6.0	15.0	37.6	67.2	328.5
50%	88.9	69.1	21.4	1.2	5.4	7.1	6.5	7.2	6.9	15.8	37.9	67.6	335.0
75%	89.4	69.5	21.6	1.2	6.6	8.8	8.3	9.3	9.0	17.1	38.3	68.2	347.3
90%	89.7	69.7	21.6	1.3	7.5	10.1	9.5	10.7	10.4	18.0	38.5	68.5	355.5
District:	**Pratapgarh**												
25%	96.1	88.5	31.2	0.8	0.4	0.2	0.2	0.1	0.2	4.0	30.4	71.7	323.8
50%	96.5	88.7	31.3	0.8	0.5	0.3	0.2	0.2	0.2	4.1	30.5	72.0	325.3
75%	97.1	89.3	31.5	0.8	0.5	0.3	0.2	0.2	0.2	4.1	30.7	72.4	327.3
90%	97.3	89.6	31.6	0.8	0.5	0.3	0.2	0.2	0.3	4.2	30.8	72.6	328.4
District:	**Rajsamand**												
25%	72.6	66.0	22.3	1.1	12.9	18.5	15.4	16.3	13.3	13.2	22.6	54.4	328.6
50%	72.9	66.2	22.4	1.1	15.1	21.7	18.0	19.1	15.6	14.8	22.8	54.6	344.3
75%	73.3	66.6	22.5	1.2	19.0	27.3	22.7	24.1	19.8	17.8	23.0	55.1	372.4
90%	73.5	66.8	22.6	1.2	21.7	31.3	26.0	27.6	22.7	19.9	23.1	55.3	391.7
District:	**Sawai Madhopur**												
25%	81.0	57.6	13.6	0.4	0.1	0.1	0.2	0.2	1.1	31.5	55.5	56.7	298.0
50%	81.5	57.9	13.6	0.4	0.1	0.1	0.2	0.3	1.3	31.9	56.1	57.1	300.5
75%	82.1	58.3	13.7	0.4	0.2	0.1	0.3	0.4	1.7	32.5	56.7	57.8	304.2
90%	82.4	58.5	13.7	0.4	0.2	0.1	0.4	0.5	2.0	32.8	57.1	58.2	306.3
District:	**Sikar**												
25%	54.3	47.6	16.0	1.1	0.5	0.1	6.5	10.4	13.7	13.7	24.8	39.5	228.2
50%	54.5	47.9	16.1	1.1	0.5	0.1	8.5	13.6	18.1	15.5	25.0	39.7	240.6
75%	54.8	48.1	16.2	1.1	0.5	0.1	12.7	20.3	27.2	19.1	25.2	40.0	265.3
90%	55.0	48.3	16.2	1.1	0.5	0.1	15.3	24.4	32.8	21.4	25.3	40.1	280.5
District:	**Sirohi**												
25%	86.4	71.8	26.9	7.7	3.3	4.2	5.7	6.6	7.5	15.3	34.7	64.6	334.7
50%	86.8	72.0	27.1	7.8	3.8	4.9	6.8	8.0	9.1	16.2	34.9	64.9	342.3
75%	87.3	72.5	27.3	7.9	4.6	6.1	9.0	10.7	12.3	18.0	35.3	65.4	356.4
90%	87.5	72.7	27.4	8.0	5.2	6.9	10.5	12.5	14.5	19.2	35.5	65.7	365.6
District:	**Tonk**												
25%	81.1	57.3	13.4	0.6	0.2	0.3	0.5	0.6	1.0	30.7	55.0	56.9	297.6
50%	81.5	57.5	13.5	0.6	0.2	0.3	0.5	0.7	1.2	31.0	55.4	57.2	299.6
75%	82.1	58.0	13.6	0.6	0.3	0.4	0.7	1.0	1.7	31.5	55.9	57.7	303.5
90%	82.4	58.1	13.6	0.6	0.3	0.4	0.9	1.2	2.0	31.8	56.2	58.0	305.5
District:	**Udaipur**												
25%	99.6	88.9	29.3	0.7	0.6	0.7	0.5	0.5	0.4	7.6	32.9	73.6	335.3
50%	99.9	89.1	29.4	0.7	0.7	0.7	0.6	0.5	0.5	7.7	33.0	73.8	336.6
75%	100.5	89.6	29.6	0.8	0.8	0.9	0.7	0.7	0.6	7.9	33.3	74.2	339.6
90%	100.8	89.9	29.7	0.8	0.8	1.0	0.8	0.7	0.6	7.9	33.4	74.5	340.9

Note: As per Final Report No. 4.6

11. Surface Water Availability

11.1 Introduction

The State of Rajasthan has been divided into 15 River Basins which covers the eastern, northern and southern river catchments, while the remaining western part of the State which has virtually no distinct river valley features has been designated as Outside Basin (considered as 16th Basin).

Chapter 5 above presents a summary of the salient features of the 15 River Basins and the other, so-called Outside Basin.

Besides its internal surface water potential, Rajasthan receives water from outside the State, mainly from Ravi-Beas-Sutlej system of rivers, dams and diversions, from River Yamuna and from Narmada Canal.

This chapter presents a summary of the assessment methodology and the results regarding surface water availability for the entire State. This aspect has been presented in detail in Final Report No. 4.2 wherein the surface water availability has been assessed at basin (16 nos.), sub basin (58 nos.) and micro-watershed level (541 nos.).

11.2 Data Collection and Validation

11.2.1 General

A large volume of spatial and temporal data relating to occurrence of surface water in Rajasthan is available with different Central and State organizations such as the Central Water Commission (CWC), India Meteorological Department (IMD), Rajasthan Water Resources Department (RWRD), besides other organizations that have interest in water resources development.

11.2.2 Data Collection and Validation

The relevant data requirements have been defined by the Consultants according to the ToR requirements. Acquiring the required data and information included the following:

- Study of reports and publications and;
- Obtaining relevant data, information and maps from various agencies and organizations, including SWRPD, WRD, CWC, IMD, SRSAC (Jodhpur) and others.

Data Collection

Reconnaissance of all the river basins of Rajasthan has been carried out by the Consultants in order to assess the hydrological characteristics of watersheds, the stream network, regional geology, soil characteristics, land use, hydrogeological characteristics, climate and topographic features. Satellite imageries produced by

State Remote Sensing Application Centre (SRSAC), Jodhpur and other organizations and sources have been studied by the Consultants.

In addition, the Consultants have received from the State Water Resources Planning Department (SWRPD) digitised maps and records required for the performance of the present Study.

The following data related to surface water have been collected and used:

- Rainfall data of 542 rain gauge stations at daily intervals were provided by Water Resources Department (WRD), Jaipur for the period 1957-2010 (54 years) for rain gauge stations maintained by Indian Meteorological Department (IMD), Water resources Department (WRD) and Revenue Department. The availability of rainfall data within this period of observation varied between the stations.
- Data on monthly weather parameters for 30 stations were collected from IMD weather stations that include maximum and minimum temperature, wind speed, solar radiation, evaporation and relative humidity for the time period of 1990-2009 (20 years).
- Monthly data of 52 Gauge and Discharge (G&D) sites which can be used for assessment of surface water yields were collected - 25 stream flow gauging sites maintained by Water Resources Department (WRD) and 27 by Central Water Commission (CWC) sites, located inside and outside Rajasthan. (refer Appendix 6).
- Reservoir gauge-capacity data of Major/Medium projects from WRD.
- Salient features of existing Major, Medium and Minor projects from WRD.

It is important to note the difficulties and constraints that were encountered in the course of data collection, which were as follows:

- Some of the past-years data are recorded and maintained on hard copies, which may have human error elements while recording the values.
- Poor maintenance of stations and instruments.
- Missing continuous time series data.
- Incorrect and ambiguous records in the series, due to faulty instruments and/or human error.
- Values, writing records, interpolation of data, as well as unrecorded data in the series.

All the collected data were analysed for formatting, data completeness, missing records, duplicities and inconsistencies, and then subjected to the following reviews and analyses:

Consistency Checks

Consistency checks were performed to examine the behaviour of rainfall data at a number of locations. It was used to determine whether there is a need for corrections to account for changes in data collection procedures or other local conditions. Such changes may result from a variety of causes, including changes in

instrumentation, observation procedures, or gauge location or in the surrounding conditions.

Double mass-curve analyses have been used for checking consistency of hydrological and meteorological records. It is considered an essential tool for consistency checks. In case of inconsistency, a change in slope of the straight plot is encountered, but only significant changes in slope were considered. Conventionally, values of a previous period, i.e., before the change in slope are adjusted to the current period, i.e., after the change in slope were adjusted by a factor that is the ratio between the slope after the change-point to the slope before the change.

Filling Gaps in Rainfall Data

Precipitation data are the most important input in hydrogeological models. In several river basins, collected records have large number of missing data (days, months and years). This could be due to various circumstances, for instance: absence of observers, problems with the measuring devices, loss of records, or lack of funds to continue with the measurements. Before applying any hydrological model, data analyses have been first executed to obtain complete records.

Delineation of Basin Boundaries

In current study basin, sub-basin and micro-watershed boundaries have been delineated for the entire State using SRTM DEM (Shuttle Radar Topographic Mission, 90 m resolution data). Historically watersheds were delineated manually. This process is labor intensive, slow, tedious, inconsistent and error-prone. DEM-based techniques can efficiently form the basis of a geographic information system designed to address watershed based analysis. Applications to benefit from these techniques include evaporation modeling, tracing drainage paths and hydrologic simulation modelling. These techniques were incorporated into commercially viable PC-based GIS systems.

A key component of watershed modelling is determining the drainage area that contributes flow to that point on the landscape, doing so requires identifying channels and divides and delineating watersheds. A watershed is the upslope area that contributes flow to a common outlet as concentrated drainage. The boundaries between watersheds are termed drainage divides. The outlet is the point on the surface at which water flows out of an area. It is the lowest point along the boundary of a watershed.

In earlier studies contours were used as primary source of elevation inputs and watersheds were hand drawn by looking at contour values and direction. In current study watersheds were delineated from SRTM DEM by computing the flow direction of each cell in the raster. The model identifies the ridge lines between the basins using elevation values from raster data (SRTM DEM) and creates the basin boundary. Outlet points are then defined which may be features, such as dams or stream gauges or any other outlet point for which contributing area has to be determined. Here basins were delineated considering outlet points outside Rajasthan also, so as to cover complete area within Rajasthan boundary. In earlier

1998 TAHAL study report, 15 river basins (including Outside basin) were delineated and demarcated. During the current study, the base reference basin/sub-basin boundaries by SRSAC, Jodhpur were received from SWRPD in which they have demarcated 14 basins (excluding Outside basin) and 50 sub-basins. In the present updated study SRTM 90m resolution DEM was used to delineate the basins/sub-basins boundaries. Keeping SRSAC provided boundaries as base and reference outlets were selected and basins were delineated. In addition to 14 basins of SRSAC, consultants additionally delineated two more basins namely Outside basin and Ghaggar basin. Although Outside basin does not have visible stream channel but still basin/sub-basin/micro-watershed boundaries were delineated using DEM generated flow path. This covers entire Rajasthan state and resulted in demarcation of 16 river basins, 58 sub-basins and 541 micro-watersheds.

At few locations slight differences were found in the present study and SRSAC, Jodhpur. Major change in basin boundary is of Luni basin where SRTM DEM elevation values showed that there is considerable area lying on right bank of Luni river which has been considered as part of Outside basin but should form part of Luni river basin. There are some visible channels which also proves the inclusion of such area of outside basin in to Luni basin. Hence, catchment area of right bank of Luni river is included in the basin boundary which was earlier shown as part of Outside basin after discussion with SWRPD.

A comparative analysis of Basins and Sub-basins in various studies is presented below:

Boundary	Count in TAHAL 1998 report	Count in SRSAC, Jodhpur reference boundaries	Count in present 2010 study	Remarks
Basin	15 (including Outside basin)	14 (excluding Outside basin)	16	Ghaggar basin treated as separate basin in present study which was earlier part of Outside basin.
Sub-basin	57	50 (with respect to 1998 study: 1, 1, 2, 3, 1 sub-basin reduced in Shekhawati, Banas, Chambal, Luni and Outside basin, respectively, while 1 sub-basin increased in Mahi basin. Overall, reduction of 8 and increase of 1, so net reduction of 7 sub-basins.	58	Number of sub-basins increases by 8 (=7 + 1) with respect to SRSAC reference boundaries due to division of Outside basin in 7 sub-basins and considering Ghaggar as a separate basin.
Micro-watershed	-	-	541	Micro-watersheds are part of present 2010 study only.

11.3 Modelling for Surface Waters Originating within Rajasthan

In the earlier study by TAHAL-WAPCOS (1994-1998), surface water availability was evaluated with the help of the MRS model, which was developed by the Consultants at that stage. For the present study, the MRS model was replaced by SWAT model for hydrological modelling (Soil and Water Assessment Tool).

The SWAT is a distributed parameter and continuous time simulation model. It has been developed to predict the response of water and sediment yields to natural inputs as well as man-made interventions in un-gauged catchments. The model is (a) physically based, (b) uses readily available inputs, (c) computationally efficient to operate and, (d) time-continuous and capable of simulating long periods to compute the effects of basin management changes.

Surface water availability within each basin, sub-basin and micro-watershed has been evaluated with the help of the model used for the analysis. Water availability for each basin, sub-basin and micro-watershed has been evaluated at 25%, 50%, 75% and 90% climatic dependability levels.

True runoff, or virgin flow, is a stream flow in its natural conditions, i.e. without the existence of any irrigation, municipal, or industrial water supply development (including impact of imported water, return flows and flow diversions).

Natural (Virgin) flow volumes have been computed by a water balance that includes outflow from the river basin at its terminal point plus all upstream abstractions. Upstream diversion values are taken as averages of series of values during the balance period.

The impacts of upstream stream flow interception by watershed works and water harvesting structures (WHS) are considered as a substantial factor in the basin's water balance. There are numerous such structures and their numbers and locations are identified on satellite images available with the SRSAC (State Remote Sensing Application Centre), Jodhpur. Water body polygons are provided by SRSAC, Jodhpur in GIS format which were further updated by the Consultants using latest (Oct-Nov 2010) satellite imageries. Surface water body maps have been prepared based on filtered polygons on the basis of the adopted threshold size, and then verified according to the latest satellite images. Further details of extraction and digitization are given in Appendix 7.

The stream flow series have been validated against recorded inflow values according to the relevant G&D data or reservoir data after considering all the upstream interceptions. The series were then analysed for average and corresponding dependability levels (larger dependability levels being of lesser flow rates).

11.3.1 Development of Hydrological Model

Mapping of a basin on to the SWAT hydrological model involves an elaborate procedure. The following paragraphs briefly describe the methodology used for mapping.

Development of SWAT hydrological modelling involves several steps which are mentioned below.

11.3.1.1 Input data required for modelling

- *Digital Elevation Model (DEM) – Grid (raster)*
- *Landuse – Grid (raster) or Shape (vector)*
- *Soil – Grid (raster) or Shape (vector)*
- *Meteorological data with location*
- *Optional*
    - Mask
    - Drainage for burn
    - Outlet locations
    - Reservoir/River gauge locations

11.3.1.2 Key procedures necessary for development of model

- *Delineate the watershed for modelling*
- *Define land use and soil data grids*
- *Determine the distribution of HRU's (Hydrological Response Units) based on the DEM, land use and soil data.*
- *Define rainfall, temperature and weather data*
- *Write the SWAT input files- requires access to data on soil, weather, land cover, plant growth, etc.*
- *Edit the input files – if necessary*
- *Setup and run SWAT – requires information on simulation period, PET estimation method and other options*
- *Calibration of model with available observed data*

11.4 Basin-Wise Natural (Virgin) Surface Water Assessment

11.4.1 Shekhawati Basin

Rainfall occurs mainly during the monsoon season in Shekhawati Basin. Major portion of stream flow therefore, occurs only during these months. As mentioned earlier, Shekhawati Basin is divided into three Sub-basins namely, Dohan, Kantli and Mendha. Table 11.1 presents virgin water yield at different dependabilities for Shekhawati Basin. Annual virgin water yield at 50% dependability for Dohan, Kantli and Mendha Sub-basin is 146.6, 36.7 and 35.3 Mm^3, respectively. Annual virgin water yield at 50% dependability for Shekhawati Basin is 295.1 Mm^3 (see Table 11.1).

Mean annual virgin water yield for Dohan, Kantli and Mendha Sub-basins is 221.80, 61.27 and 206.61 Mm^3, respectively. Mean annual virgin water yield for entire Shekhawati Basin is 562.85 Mm^3.

Table 11.1: Virgin Water Yield at Four Dependability Levels – Shekhawati Basin

Dependability Level, %	Shekhawati Basin	Dohan Sub-basin	Kantli Sub-basin	Mendha Sub-basin
	Water Yield in Mm^3			
25	778.90	313.00	71.30	240.20
50	295.10	146.60	36.70	35.30
75	88.10	40.90	18.10	11.50
90	63.00	18.00	10.40	6.20
Mean	562.85	221.80	61.27	206.61

There are 25 micro-watersheds of Shekhawati Basin delineated within Rajasthan. Virgin water yield of these micro-watersheds at four levels of 25, 50, 75 and 90% dependability is shown in Table 11.2.

Table 11.2: Virgin Water Yield at Four Dependability Levels – Micro-watersheds of Shekhawati Basin

Micro-watershed Code	Dependability Level, %				Mean
	25	50	75	90	
	Water Yield, Mm^3				
001	17.60	3.20	1.10	0.50	14.40
002	29.70	11.50	2.70	2.30	25.70
003	59.90	29.80	6.40	0.90	43.40
004	69.80	37.00	6.90	1.00	53.40
005	80.20	25.00	6.50	3.20	54.60
006	24.40	8.40	2.60	1.20	17.70
007	13.20	6.30	2.60	2.10	12.60
008	8.90	5.10	1.80	1.40	7.60
009	18.30	4.70	1.90	0.70	14.70
010	28.60	9.60	3.90	2.80	18.40
011	1.30	0.30	0.00	0.00	1.30
012	21.30	11.40	4.00	3.30	19.20
013	0.50	0.30	0.10	0.10	2.50
014	6.70	3.00	2.00	1.20	16.70
015	0.30	0.10	0.10	0.10	3.80
016	49.00	1.00	0.60	0.50	30.10
017	1.00	0.40	0.30	0.20	12.80
018	4.30	2.40	1.20	0.90	19.80
019	4.60	1.10	0.40	0.20	7.30
020	0.50	0.20	0.10	0.10	6.60
021	19.70	0.20	0.00	0.00	11.70
022	25.00	0.50	0.10	0.10	13.90

Micro-watershed Code	Dependability Level, %				Mean
	25	50	75	90	
	Water Yield, Mm^3				
023	30.70	5.80	1.60	0.80	22.60
024	62.10	1.20	0.50	0.20	44.10
025	5.70	2.50	1.40	0.80	14.70

11.4.2 Ruparail Basin

Rainfall occurs mainly during the monsoon season in Ruparail Basin therefore major portion of stream flow occurs only during monsoon months. Table 11.3 presents virgin water yield at different dependabilities for Ruparail Basin. At 50% dependability level, the virgin water yield of Ruparail Basin is 465.40 Mm^3 while at mean it is 641.38 Mm^3.

Table 11.3: Virgin Water Yield at Four Dependability Levels – Ruparail Basin

Dependability Level, %	Water Yield, Mm^3
25	833.50
50	465.40
75	291.80
90	113.30
Mean	641.38

There are 14 micro-watersheds delineated in Ruparail Basin within Rajasthan boundary, virgin water yield of these micro-watersheds at four levels of 25, 50, 75 and 90% dependability is shown in Table 11.4.

Table 11.4: Virgin Water Yield at Four Dependability Levels – Micro-watersheds of Ruparail Basin

Micro-watershed Code	Dependability Level, %				Mean
	25	50	75	90	
	Water Yield, Mm^3				
1	104.70	56.20	31.60	3.70	70.80
2	95.90	60.60	28.20	0.80	67.70
3	120.30	62.50	36.00	19.10	82.90
4	43.20	22.80	13.60	5.50	30.40
5	41.00	18.70	10.20	0.90	27.10
6	63.10	32.30	11.60	0.10	47.90
7	68.40	35.60	19.30	10.60	47.60
8	80.70	47.90	18.20	7.80	51.50
9	76.50	44.80	15.00	1.80	55.80
10	11.40	6.60	1.90	0.30	9.00
11	33.00	19.50	6.10	1.00	24.30
12	63.00	26.90	5.80	0.30	45.80

Micro-watershed Code	Dependability Level, %				Mean
	25	50	75	90	
	Water Yield, Mm³				
13	41.10	21.40	11.70	2.80	29.60
14	72.30	33.30	20.50	4.10	51.10

11.4.3 Banganga Basin

Rainfall occurs mainly during the monsoon season in Banganga Basin. Major portion of stream flow therefore, occurs only during these months. Table 11.5 presents virgin water yield at different dependabilities for Banganga Basin. At 50% dependability level, the virgin water yield in Banganga Basin is 563.50 Mm^3 while at mean it is 754.83 Mm^3.

Table 11.5: Virgin Water Yield at Four Dependability Levels – Banganga Basin

Dependability Level, (%)	Water Yield, Mm³
25	1,078.30
50	563.50
75	289.00
90	180.00
Mean	754.83

There are 32 micro-watershed delineated in Banganga Basin, virgin water yield of these micro-watersheds at four levels of 25, 50, 75 and 90% dependability is shown in Table 11.6.

Table 11.6: Virgin Water Yield at Four Dependability levels of Micro-watersheds of Banganga Basin

Micro-watershed Code	Dependability Level, %				Mean
	25	50	75	90	
	Water Yield, Mm³				
001	27.50	11.70	7.30	3.60	19.40
002	20.70	7.60	4.80	3.40	13.00
003	25.30	9.20	0.70	0.00	20.80
004	17.20	6.70	2.70	1.30	11.40
005	44.50	16.20	6.00	3.50	29.10
006	26.70	9.00	1.40	0.20	15.40
007	7.20	1.00	0.00	0.00	6.40
008	55.00	18.60	3.30	0.10	28.10
009	31.60	14.00	3.60	1.90	19.40
010	53.20	13.90	3.20	1.80	40.60
011	25.30	13.50	8.30	4.90	17.20
012	7.30	2.70	0.00	0.00	4.80
013	40.10	7.90	0.80	0.30	22.10
014	54.70	32.20	8.50	1.70	42.90
015	12.20	4.60	1.50	1.00	10.00
016	36.30	7.80	1.60	0.80	27.30

Micro-watershed Code	Dependability Level, %				Mean
	25	50	75	90	
	Water Yield, Mm^3				
017	41.90	7.10	0.60	0.20	21.30
018	14.80	6.70	0.10	0.00	12.60
019	28.70	9.30	6.10	4.10	16.80
020	25.50	13.40	3.40	1.00	19.90
021	27.40	11.40	4.80	2.90	22.50
022	24.30	4.90	0.80	0.00	17.60
023	47.20	18.80	11.80	6.30	29.60
024	51.70	28.20	17.00	10.50	38.90
025	77.30	43.60	18.00	4.20	49.60
026	15.30	3.20	0.30	0.10	9.00
027	12.00	3.10	1.30	0.60	6.40
028	9.80	4.20	1.10	0.40	6.40
029	52.10	15.00	9.70	6.40	28.70
030	112.80	48.70	32.70	21.10	69.20
031	19.50	0.90	0.10	0.10	10.00
032	87.70	54.60	18.90	3.00	68.80

11.4.4 Gambhir Basin

Rainfall occurs mainly during the monsoon season in Gambhir Basin. Major portion of stream flow therefore, occurs only during these months. Table 11.7 presents virgin water yield at different dependabilities for Gambhir Basin. At 50% dependability level, the virgin water yield of Gambjir Basin is 568.40 Mm^3 while at mean it is 700.89 Mm^3. Annual Virgin water yield for the area of Gambhir Basin lying within Rajasthan is 700.89 Mm^3.

Table 11.7: Virgin Water Yield at Four Dependability Levels – Gambhir Basin

Dependability Level, %	Water Yield, Mm^3
25	996.00
50	568.40
75	237.20
90	106.60
Mean	700.89

There are 16 micro-watersheds delineated in Gambhir Basin, virgin water yield dependability of these micro-watersheds at four levels of 25, 50, 75 and 90% dependability is shown in Table 11.8.

Table 11.8: Virgin Water Yield at Four Dependability Levels - Gambhir Basin

Micro-watershed Code	Dependability Level, %				Mean
	25	50	75	90	
	Water Yield, Mm^3				
001	8.40	4.60	0.80	0.00	5.20
002	187.20	40.20	3.90	1.60	101.40
003	60.20	23.90	5.30	0.70	34.70

Micro-watershed Code	Dependability Level, %				Mean
	25	50	75	90	
	Water Yield, Mm^3				
004	91.20	48.70	8.30	0.10	59.40
005	51.30	31.40	19.30	1.50	35.40
006	65.90	25.60	3.10	0.30	39.00
007	114.30	46.60	7.10	0.30	68.40
008	85.10	10.00	0.50	0.00	48.20
009	61.10	34.50	7.10	1.60	39.10
010	83.20	43.60	5.00	0.10	52.20
011	36.90	7.90	2.50	0.50	20.70
012	47.80	21.70	9.90	2.70	32.00
013	78.60	49.60	22.10	7.30	55.40
014	67.80	29.90	3.00	0.00	40.00
015	48.10	26.80	3.50	0.00	32.20
016	61.10	23.80	6.90	0.10	37.80

11.4.5 Parbati Basin

Rainfall occurs mainly during the monsoon season in Parbati Basin. Major portion of stream flow therefore occurs only during these months. Table 11.9 presents virgin water yield at different dependabilities for Parbati Basin. At 50% dependability level, the virgin water yield of Parbati Basin is 380.10 Mm^3 while at mean it is 427.18 Mm^3.

Table 11.9: Virgin Water Yield at Four Dependability Levels – Parbati Basin

Dependability Level, %	Water Yield, Mm^3
25	574.90
50	380.10
75	235.60
90	148.60
Mean	427.18

There are 20 micro-watersheds delineated in Parbati Basin, virgin water yield of these micro-watersheds at four levels of 25, 50, 75 and 90% dependability is shown in Table 11.10.

Table 11.10: Virgin Water Yield at Four Dependability Levels – Micro-watersheds of Parbati Basin

Micro-watershed Code	Dependability Level, %				Mean
	25	50	75	90	
	Water Yield, Mm^3				
001	8.90	5.40	1.80	0.00	5.60
002	53.60	35.40	16.90	8.60	39.10
003	21.50	15.40	8.60	5.60	16.50
004	38.70	23.00	16.80	10.60	29.10
005	32.50	19.10	14.20	8.60	24.50
006	12.30	6.80	4.70	2.60	9.00

Micro-watershed Code	Dependability Level, %				Mean
	25	50	75	90	
	Water Yield, Mm^3				
007	38.00	26.90	14.80	9.40	28.90
008	17.70	11.70	8.20	5.00	13.60
009	28.40	15.40	11.00	5.70	20.60
010	39.10	27.60	15.20	10.00	30.10
011	26.40	14.30	10.50	5.70	19.30
012	26.20	16.70	6.30	0.30	16.80
013	28.70	14.40	9.50	5.00	20.10
014	10.30	5.70	2.30	0.40	7.00
015	30.30	17.60	8.60	3.60	21.70
016	31.50	20.00	7.20	1.30	20.40
017	34.00	19.60	9.10	3.30	24.00
018	64.00	44.40	24.30	15.50	48.40
019	32.40	21.00	9.50	4.40	23.40
020	13.90	9.10	2.80	0.20	9.10

11.4.6 Sabi Basin

Rainfall occurs mainly during the monsoon season in Sabi Basin. Major portion of stream flow therefore occurs only during these months. Table 11.11 presents virgin water yield at different dependabilities for Sabi Basin. At 50% dependability level, the virgin water yield of Sabi Basin is 199.00 Mm^3 while at mean it is 348.09 Mm^3.

Table 11.11: Virgin Water Yield at Four Dependability Levels – Sabi Basin

Dependability Level, %	Water Yield, Mm^3
25	457.30
50	199.00
75	94.60
90	40.70
Mean	348.09

There are 20 micro-watersheds delineated in Sabi Basin within Rajasthan, virgin water yield of these micro-watersheds at four levels of 25, 50, 75 and 90% dependability is shown in Table 11.12.

Table 11.12: Virgin Water Yield at Four Dependability Levels – Micro-watersheds of Sabi Basin

Micro-watershed Code	Dependability Level, %				Mean
	25	50	75	90	
	Water Yield, Mm^3				
001	7.00	1.80	0.40	0.00	6.40
002	18.70	8.40	5.10	2.60	16.60
003	14.70	8.60	3.50	1.80	14.30
004	9.50	3.40	1.30	0.40	8.00
005	12.80	3.40	1.20	0.30	11.90

Micro-watershed Code	Dependability Level, %				Mean
	25	50	75	90	
	Water Yield, Mm^3				
006	8.70	4.80	1.20	0.10	9.40
007	16.00	3.30	1.00	0.10	14.10
008	17.90	5.50	1.50	0.50	16.60
009	5.10	2.10	0.50	0.10	5.30
010	6.50	2.40	0.80	0.20	7.50
011	19.30	7.10	4.00	1.50	20.90
012	17.70	6.50	0.90	0.10	18.80
013	10.80	3.40	0.90	0.30	12.40
014	44.30	18.70	3.60	1.50	28.60
015	57.20	22.00	3.30	1.50	36.10
016	44.80	14.70	5.20	3.90	35.40
017	21.00	8.50	3.70	2.60	14.90
018	29.40	10.20	2.90	0.60	19.10
019	37.50	13.90	5.20	1.40	33.20
020	22.30	7.40	2.50	1.10	18.50

11.4.7 Banas Basin

Rainfall in Banas Basin occurs mainly during the monsoon season. The major portion of stream flows therefore occurs during these months. As mentioned earlier, Banas Basin is divided into ten Sub-basins namely, Banas, Berach, Dain, Gudia, Kalisil, Khari, Kothari, Mashi, Morel and Sodra. Table 11.13 presents virgin water yield at different dependabilities for Banas Basin. Annual virgin water yield at 50% dependability for Banas, Berach, Dain, Gudia, Kalisil, Khari, Kothari, Mashi, Morel and Sodra Sub-basin is 1303.1, 1037.9, 168.6, 77.3, 67.9, 400.0, 165.3, 309.5, 548.2 and 93.7 Mm^3, respectively. Annual virgin water yield at 50% dependability for Banas Basin is 4471.9 Mm^3 (see Table 11.13).

Mean annual virgin water yield for Banas, Berach, Dain, Gudia, Kalisil, Khari, Kothari, Mashi, Morel and Sodra Sub-basins is 1352.4, 1199.3, 194.6, 112.1, 85.4, 492.3, 176.5, 490.8, 843.1 and 150.9 Mm^3, respectively. Mean annual virgin water yield for entire Banas Basin is 5097.3 Mm^3.

Table 11.13: Virgin Water Yield at Four Dependability Levels – Banas Basin and its Sub-basins

Dependability Level, %	Banas Basin	Sub-basins									
		Banas	Berach	Dain	Gudia	Kalisil	Khari	Kothari	Mashi	Morel	Sodra
	Water Yields, Mm^3										
25	6,930.40	1,703.00	1,495.50	279.00	161.90	116.10	720.40	260.20	699.10	1,131.90	206.80
50	4,471.90	1,303.10	1,037.90	168.60	77.30	67.90	400.00	165.30	309.50	548.20	93.70
75	3,262.60	904.30	670.60	75.10	34.90	29.40	274.60	63.20	131.30	377.70	37.60
90	2,425.20	498.40	505.50	13.10	19.60	12.10	143.90	25.30	42.40	181.50	16.40
Mean	5,097.26	1,352.39	1,199.30	194.57	112.06	85.35	492.31	176.54	490.81	843.09	150.85

There are 71 micro-watersheds in Banas Basin, virgin water yield of these micro-watersheds at four levels of 25, 50, 75 and 90% dependability is shown in Table 11.14.

Table 11.14: Virgin Water Yield at Four Dependability Levels – Micro-watersheds of Banas Basin

Micro-watershed Code	Dependability Level, %				Mean
	25	50	75	90	
	Water Yield, Mm^3				
001	244.00	93.90	31.00	4.50	147.10
002	129.70	71.70	33.50	12.30	85.10
003	211.50	139.80	64.90	22.10	149.00
004	352.80	202.60	116.40	60.50	234.90
005	48.60	25.10	7.00	3.20	32.10
006	258.90	150.00	42.00	12.90	153.70
007	56.10	20.70	5.90	1.80	31.80
008	40.80	20.90	6.70	0.30	30.20
009	53.80	29.20	11.90	3.20	37.60
010	169.00	106.50	49.20	25.70	143.40
011	76.00	45.10	14.70	7.80	50.20
012	123.30	42.30	12.00	1.20	74.30
013	82.90	42.80	15.80	8.50	60.90
014	45.20	26.80	13.60	3.30	29.60
015	88.80	55.40	33.60	11.60	60.10
016	41.20	32.10	16.90	11.80	32.50
017	97.60	57.80	26.90	13.60	82.40
018	283.80	154.60	97.30	24.60	198.30
019	4.80	3.50	1.40	0.50	3.80
020	6.10	3.70	1.70	0.40	5.10
021	96.90	70.00	35.20	14.90	75.10
022	37.40	24.90	12.50	2.80	29.70
023	120.60	77.20	36.30	9.40	96.10
024	39.60	25.20	11.90	5.00	28.40
025	54.70	23.60	8.20	4.60	35.50
026	30.60	19.50	9.10	4.00	22.60
027	71.90	52.00	25.80	13.10	56.70
028	33.80	24.80	15.80	8.70	31.10
029	178.40	139.50	85.70	50.00	159.20
030	12.10	7.50	4.70	1.70	8.80
031	59.00	37.30	23.80	9.70	44.40
032	40.00	28.10	18.30	9.10	31.20
033	67.40	41.60	29.40	17.90	50.20
034	145.50	100.00	59.80	29.00	110.70
035	99.00	66.50	33.80	17.80	73.20
036	71.40	41.90	18.60	7.00	56.70
037	108.70	58.40	17.20	3.10	68.00
038	141.90	78.90	32.80	3.50	102.40
039	40.40	11.90	2.00	0.60	24.10

Micro-watershed Code	Dependability Level, %				Mean
	25	50	75	90	
	Water Yield, Mm^3				
040	133.20	60.60	21.90	9.10	89.50
041	32.20	17.40	6.10	1.40	22.60
042	80.40	39.30	20.40	1.60	51.90
043	46.10	25.60	6.50	0.80	33.50
044	7.20	3.20	1.90	0.20	5.80
045	61.70	35.90	16.80	4.80	50.20
046	123.60	63.80	22.80	3.30	98.70
047	105.30	54.90	18.60	7.30	62.60
048	45.00	27.70	14.70	2.90	35.60
049	84.20	57.00	23.90	4.60	67.50
050	80.00	50.00	26.90	5.50	55.80
051	103.90	42.60	25.70	4.80	61.00
052	86.10	40.60	15.50	4.90	55.30
053	14.40	9.10	3.70	1.20	10.20
054	124.10	33.10	4.10	0.30	68.00
055	157.40	99.20	38.00	15.20	98.30
056	73.40	33.30	4.70	0.80	41.80
057	87.30	31.60	6.60	1.90	48.40
058	196.30	69.40	12.30	3.20	123.40
059	219.70	65.80	20.80	0.60	157.40
060	111.40	38.80	22.40	4.50	67.80
061	87.70	25.00	6.00	0.80	52.10
062	99.40	50.20	26.50	10.90	66.40
063	226.30	97.00	47.80	19.90	171.20
064	86.10	44.60	25.90	3.60	54.70
065	297.60	150.90	67.40	19.30	206.50
066	29.40	12.20	6.90	2.60	20.70
067	100.50	67.30	23.50	11.60	83.10
068	319.00	141.30	73.30	25.20	240.50
069	40.80	15.20	7.80	3.30	26.80
070	51.30	22.90	3.30	1.10	41.60
071	134.10	50.60	6.40	3.40	82.50

11.4.8 Chambal Basin

Rainfall occurs mainly during the monsoon season in Chambal Basin therefore major portion of stream flow occurs only during these months at Chambal Basin Outlet, but there is also a large contribution of water that is coming from Madhya Pradesh catchment of Chambal. As mentioned earlier, Chambal Basin is divided into seven Sub-basins namely, Chakan, Chambal Downstream, Chambal Upstream, Kalisindh, Kunu, Mej, and Parwati. Table 11.15 presents virgin water yield at different dependabilities for Chambal Basin generated within Rajasthan. Annual virgin water yield at 50% dependability for Chakan, Chambal Downstream, Chambal Upstream, Kalisindh, Kunu, Mej, and Parwati Sub-basin is 242.0, 1026.7,

1640.2, 3770.6, 235.5, 1359.8 and 1873.8 Mm^3, respectively. Annual virgin water yield at 50% dependability for Chambal Basin is 9921.7 Mm^3 (see Table 11.15).

Mean annual virgin water yield for Chakan, Chambal Downstream, Chambal Upstream, Kalisindh, Kunu, Mej, and Parwati Sub-basins is 246.9, 1068.1, 1787.6, 3759.2, 265.3, 1415.4 and 1947.2 Mm^3, respectively. Mean annual virgin water yield for entire Chambal Basin is 10489.8 Mm^3.

Table 11.15: Virgin Water Yield at Four Dependability Levels – Chambal Basin and its Sub-basins

Dependability Level, %	Chakan Sub-basin	Chambal Downstream Sub-basin	Chambal Upstream Sub-basin	Kalisindh Sub-basin	Kunu Sub-basin	Mej Sub-basin	Parwati Sub-basin	Chambal Basin
	Water Yield, Mm^3							
25	338.20	1355.90	2100.50	5051.90	338.30	1805.70	2336.40	12911.30
50	242.00	1026.70	1640.20	3770.60	235.50	1359.80	1873.80	9921.70
75	150.80	780.30	1210.90	2370.80	157.60	874.70	1428.90	8139.10
90	53.30	585.20	913.80	1878.20	112.50	720.70	935.30	6265.20
Mean	246.89	1068.14	1787.61	3759.15	265.33	1415.39	1947.23	10489.75

There are 67 micro-watersheds in Chambal Basin delineated within Rajasthan, virgin water yield of these micro-watersheds at four levels of 25, 50, 75 and 90% dependability is shown in Table 11.16.

Table 11.16: Virgin Water Yield at Four Dependability Levels – Micro-watersheds of Chambal Basin

Micro-watershed code	Dependability Level, %				Mean
	25	50	75	90	
	Water Yield, Mm^3				
001	30.40	21.30	12.40	5.30	22.15
002	307.80	220.60	137.70	48.70	224.74
003	185.30	130.40	91.50	38.40	150.93
004	54.20	35.10	19.70	12.40	39.47
005	238.10	129.20	72.60	17.40	175.16
006	35.70	25.50	13.30	5.20	25.86
007	265.20	187.40	112.10	71.20	190.50
008	189.00	127.40	67.10	33.30	128.38
009	95.70	66.90	35.40	12.70	69.18
010	146.50	95.90	51.60	23.10	109.99
011	265.70	177.40	92.60	49.40	178.67
012	243.10	181.90	119.40	77.90	197.63
013	217.30	143.00	99.50	70.00	166.93
014	71.60	45.50	24.70	15.20	50.45
015	174.60	125.10	80.30	52.90	140.75
016	343.60	255.10	173.10	115.50	281.58
017	282.90	179.90	103.80	76.80	202.19
018	186.80	140.00	92.20	46.80	139.61
019	87.90	65.50	42.40	34.80	69.42

Micro-watershed code	Dependability Level, %				Mean
	25	50	75	90	
	Water Yield, Mm^3				
020	141.70	92.30	64.30	45.50	108.16
021	136.70	119.30	84.60	47.10	120.89
022	388.30	252.00	157.50	122.10	310.00
023	512.20	341.40	189.30	157.60	365.92
024	63.00	42.40	27.60	16.80	45.44
025	115.70	73.30	28.50	19.10	82.16
026	430.50	311.60	186.40	131.20	330.27
027	40.20	31.00	21.40	16.10	32.52
028	291.20	213.70	127.30	92.70	222.91
029	214.50	152.40	115.00	71.50	167.19
030	118.40	82.60	53.90	33.00	90.39
031	69.60	48.80	30.00	16.10	49.44
032	277.30	159.80	112.10	71.90	211.79
033	405.00	285.80	153.10	99.90	299.03
034	67.30	50.20	27.30	17.90	51.31
035	258.00	172.20	126.50	70.60	197.95
036	254.60	199.70	124.10	89.20	203.05
037	156.20	110.40	67.40	56.10	119.66
038	133.10	95.50	49.10	31.50	97.24
039	241.40	173.70	133.10	92.10	191.82
040	275.40	196.80	151.70	96.40	217.87
041	326.70	225.20	153.50	99.90	235.69
042	135.80	100.90	80.00	59.70	107.87
043	382.90	293.70	200.60	121.40	306.38
044	182.70	112.10	90.40	53.90	133.26
045	338.30	235.50	157.60	112.50	265.33
046	101.30	64.50	37.30	26.30	70.87
047	80.60	47.00	28.80	10.30	52.01
048	556.70	356.40	237.30	149.70	419.19
049	71.40	52.80	36.40	18.90	53.05
050	138.00	89.80	47.50	29.80	97.33
051	44.50	26.20	11.50	7.90	33.15
052	185.30	132.50	84.40	46.60	134.38
053	439.90	258.40	114.30	73.30	321.63
054	317.20	219.60	144.30	89.10	233.77
055	486.60	370.80	234.10	158.90	370.78
056	63.10	48.00	27.70	17.60	47.18
057	177.90	101.80	70.60	44.00	135.28
058	273.90	206.50	153.30	89.80	214.62
059	220.40	156.50	105.30	73.40	173.88
060	99.40	73.40	48.70	34.30	79.54
061	51.80	37.60	25.90	18.30	41.72
062	71.70	56.20	44.00	22.60	59.00

Micro-watershed code	Dependability Level, %				Mean
	25	50	75	90	
	Water Yield, Mm^3				
063	69.40	52.10	38.30	17.40	53.36
064	62.80	49.80	36.60	15.30	49.36
065	50.40	38.10	28.10	11.90	38.70
066	721.90	550.50	398.50	288.70	585.49
067	137.50	97.00	60.50	35.60	98.31

11.4.9 Mahi Basin

Rainfall occurs mainly during the monsoon season in Mahi Basin therefore major portion of stream flow occurs only during these months. As mentioned earlier, Mahi Basin is divided into six Sub-basins namely, Anas, Bhadar, Jakham, Mahi, Moran and Som. Table 11.17 presents virgin water yield at different dependabilities for Mahi Basin generated within Rajasthan. Annual virgin water yield at 50% dependability for Anas, Bhadar, Jakham, Mahi, Moran and Som Sub-basin is 363.3, 78.5, 697.1, 1899.4, 184.7 and 966.5 Mm^3, respectively. Annual virgin water yield at 50% dependability for Mahi Basin is 4119.8 Mm^3 (see Table 11.17).

Mean annual virgin water yield for Anas, Bhadar, Jakham, Mahi, Moran and Som Sub-basins is 446.9, 79.8, 764.6, 2095.6, 187.7 and 1136.4 Mm^3, respectively. Mean annual virgin water yield for entire Mahi Basin is 4710.9 Mm^3.

Table 11.17: Virgin Water Yield at Four Dependability Levels – Mahi Basin and its Sub-basins

Dependability Level, %	Anas Sub-basin	Bhadar Sub-basin	Jakham Sub-basin	Mahi Sub-basin	Moran Sub-basin	Som Sub-basin	Mahi Basin
	Water Yield, Mm^3						
25	597.40	111.70	906.30	2,782.70	264.10	1,437.70	5,769.60
50	363.30	78.50	697.10	1,899.40	184.70	966.50	4,119.80
75	245.50	41.00	524.60	1,241.90	93.50	749.40	3,054.20
90	146.30	18.40	353.50	845.40	41.20	418.80	2,331.20
Mean	446.93	79.78	764.55	2,095.60	187.69	1,136.39	4,710.94

There are 59 micro-watersheds delineated in Mahi Basin within Rajasthan, virgin water yield dependability of these micro-watersheds at four levels of 25, 50, 75 and 90% dependability is shown in Table 11.18.

Table 11.18: Virgin Water Yield at Four Dependability Levels – Micro-watersheds of Mahi Basin

Micro-watershed Code	Dependability Level, %				Mean
	25	50	75	90	
	Water Yield, Mm^3				
001	181.30	111.10	62.90	47.30	130.60
002	98.30	60.60	34.00	26.30	70.80
003	64.70	37.00	15.60	10.20	44.90
004	284.20	177.40	118.80	55.50	200.60
005	111.70	78.50	41.00	18.40	79.80
006	14.40	8.90	6.80	2.80	11.10

Micro-watershed Code	Dependability Level, %				Mean
	25	50	75	90	
	Water Yield, Mm^3				
007	106.20	91.50	65.50	34.50	89.90
008	34.20	21.80	16.70	9.80	27.80
009	90.50	59.00	44.80	25.40	73.40
010	51.80	32.90	25.80	12.20	40.30
011	77.50	53.80	40.30	26.80	64.20
012	53.80	35.20	22.90	14.40	40.00
013	123.00	104.00	73.00	36.60	102.60
014	99.50	63.00	49.50	28.80	81.40
015	68.90	57.60	41.20	20.60	57.40
016	121.10	80.20	63.40	38.60	100.40
017	90.00	77.10	55.20	29.00	76.10
018	208.00	129.60	88.40	35.90	150.70
019	202.70	121.20	80.70	35.70	140.50
020	175.80	115.70	59.10	35.80	125.00
021	43.20	27.00	18.10	10.30	30.50
022	345.90	205.90	132.00	80.50	261.80
023	199.20	116.40	66.80	52.30	136.90
024	187.10	104.90	59.90	46.80	128.20
025	168.90	110.40	65.60	36.00	128.80
026	111.60	68.50	43.80	20.40	79.70
027	160.50	109.50	70.80	32.80	119.40
028	177.90	118.70	63.00	39.80	127.30
029	111.50	78.20	47.30	33.10	83.30
030	67.70	46.50	26.20	14.20	50.50
031	118.40	81.70	53.70	26.10	87.90
032	94.30	68.00	43.60	25.50	75.10
033	85.10	57.90	45.70	28.10	71.60
034	111.60	91.00	45.80	30.30	91.50
035	14.00	8.60	5.60	1.30	9.80
036	131.80	79.60	53.10	19.00	94.10
037	134.70	87.90	54.60	41.80	103.10
038	264.10	184.70	93.50	41.20	187.70
039	20.60	12.90	10.20	4.80	15.90
040	74.00	42.70	25.00	10.30	53.70
041	115.00	94.80	41.60	15.80	92.80
042	72.70	51.30	33.90	12.00	55.60
043	43.90	30.20	22.40	7.90	35.10
044	73.50	51.40	37.60	9.40	59.40
045	52.00	35.90	27.00	7.50	42.80
046	134.40	90.10	53.10	27.80	97.90
047	89.90	60.60	35.70	19.60	65.90
048	56.40	42.50	23.20	9.90	46.40
049	59.20	35.60	13.40	1.80	41.70
050	66.80	47.30	35.40	11.80	55.90
051	94.20	70.00	37.00	15.50	75.70
052	53.20	39.50	21.80	11.30	43.30
053	78.40	54.30	31.90	15.20	59.90
054	110.10	89.10	43.70	29.00	90.00
055	64.70	47.30	24.60	9.80	52.30
056	34.30	23.50	13.70	6.20	26.20

Micro-watershed Code	Dependability Level, %				Mean
	25	50	75	90	
	Water Yield, Mm^3				
057	101.60	64.80	33.70	20.80	72.00
058	51.10	36.50	27.10	8.70	42.00
059	19.10	9.50	5.10	0.30	11.80

11.4.10 Sabarmati Basin

Rainfall occurs mainly during the monsoon season in Sabarmati Basin. Therefore, major portion of stream flow occurs only during these months. As mentioned earlier, Sabarmati Basin is divided into four Sub-basins namely, Sabarmati, Sei, Vatrak and Wakal. Table 11.19 presents virgin water yield at different dependabilities for Sabarmati Basin generated within Rajasthan. Annual virgin water yield at 50% dependability for Sabarmati, Sei, Vatrak and Wakal Sub-basin is 68.2, 47.0, 106.9 and 146.7 Mm^3, respectively. Annual virgin water yield at 50% dependability for Sabarmati Basin is 457.4 Mm^3 (see Table 11.19).

Mean annual virgin water yield for Sabarmati, Sei, Vatrak and Wakal Sub-basins is 152.1, 117.7, 143.3 and 319.4 Mm^3, respectively. Mean annual virgin water yield for entire Sabarmati Basin is 732.5 Mm^3.

Table 11.19: Virgin Water Yield at Four Dependability Levels – Sabarmati Basin and its Sub-Basins

Dependability Level, %	Sabarmati Sub-basin	Sei Sub -basin	Vatrak Sub-basin	Wakal Sub-basin	Sabarmati Basin
	Water Yield, Mm^3				
25	195.20	135.00	206.20	417.60	901.70
50	68.20	47.00	106.90	146.70	457.40
75	30.20	17.70	34.40	69.90	156.20
90	14.60	6.70	16.00	26.40	86.60
Mean	152.13	117.67	143.33	319.40	732.52

There are 15 micro-watersheds delineated in Sabarmati Basin within Rajasthan, virgin water yield of these micro-watersheds at four levels of 25, 50, 75 and 90% dependability is shown in Table 11.20.

Table 11.20: Virgin Water Yield at Four Dependability Levels – Micro-watersheds of Sabarmati Basin

Micro-watershed Code	Dependability Level, %				Mean
	25	50	75	90	
	Water Yield, Mm^3				
001	27.60	10.80	6.10	3.70	20.90
002	82.50	25.20	8.50	2.30	57.40
003	2.50	1.20	0.50	0.20	2.90
004	29.20	8.70	4.80	2.20	29.00
005	60.30	23.30	7.00	1.70	41.90
006	61.20	14.80	3.90	1.90	60.80
007	81.20	29.40	9.60	2.70	56.90

Micro-watershed Code	Dependability Level, %				Mean
	25	50	75	90	
	Water Yield, Mm^3				
008	57.90	13.60	2.20	1.30	35.20
009	155.50	87.20	28.00	14.60	108.20
010	37.60	14.70	6.30	2.80	29.40
011	70.00	27.20	10.90	4.10	53.40
012	58.40	21.90	8.60	4.40	46.90
013	27.80	16.10	8.10	5.50	37.80
014	133.40	50.20	20.80	7.40	94.70
015	82.00	29.10	10.60	3.10	57.30

11.4.11 Luni Basin

Rainfall occurs mainly during the monsoon season in Luni Basin. Major portion of stream flow therefore occurs only during these months. As mentioned earlier, Luni Basin is divided into twelve Sub-basins namely, Bandi, Bandi (Hemawas), Guhiya, Jawai, Jojri, Khari, Khari (Hemawas), Luni, Mithari, Sagi, Sukri and Sukri (Sayala). Table 11.21 presents virgin water yield at different dependabilities for Luni Basin generated within Rajasthan. Annual virgin water yield at 50% dependability for Bandi, Bandi (Hemawas), Guhiya, Jawai, Jojri, Khari, Khari (Hemawas), Luni, Mithari, Sagi, Sukri and Sukri (Sayala) Sub-basin is 7.0, 2.5, 60.3, 124.0, 78.9, 60.0, 85.8, 359.6, 29.2, 10.5, 39.1 and 3.3 Mm^3, respectively. Annual virgin water yield at 50% dependability for Luni Basin is 1155.1 Mm^3 (see Table 11.21).

Mean annual virgin water yield for Bandi, Bandi (Hemawas), Guhiya, Jawai, Jojri, Khari, Khari (Hemawas), Luni, Mithari, Sagi, Sukri and Sukri (Sayala) Sub-basins is 80.2, 42.3, 143.0, 224.9, 296.7, 167.6, 121.8, 765.3, 90.4, 100.9, 160.1 and 74.8 Mm^3, respectively. Mean annual virgin water yield for entire Luni Basin is 2269.9 Mm^3.

Table 11.21: Virgin Water Yield at Four Dependability Levels – Luni Basin and its Sub-Basins

Dependability Level, %	Bandi Sub-basin	Bandi (Hemawas) Sub-basin	Guhiya Sub-basin	Jawai Sub-basin	Jojri Sub-basin	Khari Sub-basin	Khari (Hemawas) Sub-basin	Luni Sub-basin	Mithari Sub-basin	Sagi Sub-basin	Sukri Sub-basin	Sukri (Sayala) Sub-basin	Luni Basin
	Water Yield, Mm^3												
25	151.60	6.90	208.30	260.80	314.20	167.00	173.70	1,053.10	97.90	160.00	100.30	113.00	2,888.90
50	7.00	2.50	60.30	124.00	78.90	60.00	85.80	359.60	29.20	10.50	39.10	3.30	1,155.10
75	2.70	0.20	14.40	31.50	18.00	16.20	11.00	97.50	13.80	4.70	14.40	0.60	360.90
90	1.40	0.00	4.20	18.10	5.60	13.00	5.10	41.10	7.40	2.50	7.60	0.30	214.20
Mean	80.20	42.27	143.00	224.85	296.70	167.57	121.79	765.32	90.37	100.91	160.05	74.82	2,269.92

There are 94 micro-watersheds delineated in Luni Basin within Rajasthan, virgin water yield of these micro-watersheds at four levels of 25, 50, 75 and 90% dependability is shown in Table 11.22.

Table 11.22: Virgin Water Yield at Four Dependability Levels – Micro-watersheds of Luni Basin

Micro-watershed Code	Dependability Level, %				Mean
	25	50	75	90	
	Water Yield, Mm^3				
001	43.90	1.30	0.10	0.10	26.80
002	63.70	5.10	2.50	1.30	33.20
003	40.50	0.80	0.00	0.00	20.20
004	3.80	1.50	0.10	0.00	29.30
005	2.70	1.00	0.10	0.00	12.90
006	74.10	37.20	1.60	0.50	60.10
007	2.60	0.20	0.00	0.00	5.20
008	19.80	0.40	0.20	0.10	27.30
009	2.20	0.20	0.00	0.00	3.40
010	2.80	0.20	0.10	0.00	15.30
011	0.50	0.20	0.10	0.00	10.00
012	14.10	3.50	0.00	0.00	9.40
013	18.10	4.60	2.30	1.00	12.40
014	81.20	25.10	16.20	9.60	56.80
015	26.20	8.10	2.40	1.60	35.80
016	166.20	88.30	19.20	5.40	132.30
017	6.80	1.70	0.30	0.20	32.80
018	16.20	0.60	0.20	0.10	29.30
019	2.80	0.10	0.10	0.00	8.30
020	7.20	0.40	0.10	0.00	10.40
021	12.80	0.40	0.00	0.00	21.90
022	23.10	2.10	0.60	0.00	26.70
023	60.20	5.80	1.80	0.10	66.80
024	16.20	1.70	0.50	0.00	16.20
025	58.40	6.20	1.10	0.30	47.20
026	18.50	0.70	0.10	0.10	20.50
027	4.00	0.10	0.10	0.00	10.60
028	9.50	1.00	0.10	0.00	5.90
029	17.50	3.60	2.10	1.30	12.10
030	39.40	7.70	3.90	2.40	75.60
031	38.20	12.30	4.40	3.20	41.60
032	43.00	5.50	1.10	0.70	29.80
033	15.20	4.60	2.60	1.40	10.50
034	0.50	0.00	0.00	0.00	0.90
035	0.60	0.00	0.00	0.00	2.00
036	4.90	1.30	0.10	0.00	23.70
037	108.10	79.10	9.40	4.10	95.20
038	8.20	1.30	0.20	0.10	6.00
039	59.30	3.00	0.20	0.00	42.00
040	5.00	0.70	0.30	0.20	3.80
041	7.40	1.10	0.30	0.30	5.50
042	8.60	1.90	0.00	0.00	6.40

Micro-watershed Code	Dependability Level, %				Mean
	25	50	75	90	
	Water Yield, Mm^3				
043	18.20	6.20	2.60	1.50	15.30
044	18.10	7.00	4.30	1.90	23.80
045	35.20	4.10	0.10	0.00	24.40
046	25.10	2.50	0.00	0.00	14.60
047	2.40	0.70	0.30	0.20	7.70
048	2.00	0.40	0.20	0.10	2.50
049	9.30	1.90	0.90	0.50	33.30
050	69.20	10.80	1.50	0.40	56.60
051	25.80	1.70	0.50	0.30	20.30
052	53.10	6.40	1.00	0.70	30.80
053	3.00	0.60	0.30	0.20	3.50
054	0.60	0.30	0.10	0.10	1.50
055	50.40	4.60	0.10	0.10	36.70
056	2.80	0.20	0.10	0.00	3.20
057	24.60	2.50	0.30	0.20	18.10
058	2.00	0.40	0.20	0.10	2.40
059	4.30	0.80	0.40	0.20	5.00
060	0.70	0.20	0.10	0.00	8.40
061	1.80	0.40	0.20	0.10	2.10
062	4.20	1.00	0.40	0.20	10.90
063	3.20	0.60	0.30	0.20	3.70
064	11.20	2.60	0.90	0.50	27.10
065	3.40	1.60	0.80	0.50	8.80
066	27.80	9.50	6.20	3.70	23.90
067	5.30	0.70	0.20	0.10	10.20
068	14.40	9.20	5.60	4.00	19.90
069	1.50	0.50	0.20	0.20	7.90
070	5.20	3.80	2.40	0.70	14.40
071	0.80	0.50	0.30	0.10	4.30
072	1.10	0.50	0.30	0.10	5.10
073	1.00	0.70	0.40	0.10	4.60
074	1.00	0.50	0.30	0.10	4.80
075	0.80	0.40	0.20	0.10	4.30
076	0.60	0.30	0.20	0.00	3.10
077	39.70	8.10	4.00	2.30	45.30
078	0.60	0.40	0.20	0.10	2.30
079	1.40	0.70	0.40	0.10	7.40
080	1.30	0.60	0.40	0.10	6.00
081	3.80	2.50	1.50	0.40	14.60
082	1.50	0.70	0.40	0.10	7.00
083	5.40	0.90	0.50	0.10	17.50
084	241.60	10.70	2.30	0.60	138.60
085	50.30	13.80	8.80	5.40	36.20
086	42.50	12.60	2.90	1.90	54.20
087	143.20	10.00	4.60	2.40	90.10
088	16.70	0.50	0.10	0.00	10.80
089	0.40	0.10	0.00	0.00	10.80
090	9.50	1.30	0.70	0.30	26.90
091	40.20	14.00	7.10	2.20	80.00
092	5.50	0.50	0.00	0.00	18.60

Micro-watershed Code	Dependability Level, %				Mean
	25	50	75	90	
	Water Yield, Mm^3				
093	11.80	4.40	1.70	1.30	23.80
094	113.00	3.30	0.60	0.30	74.80

11.4.12 West Banas Basin

Rainfall occurs mainly during the monsoon season in West Banas Basin. Major portion of stream flow therefore occurs only during these months. Table 11.23 presents virgin water yield at different dependabilities for West Banas Basin. At 50% dependability level, the virgin water yield of West Banas Basin is 133.9 Mm^3 while at mean it is 222.1 Mm^3.

Table 11.23: Virgin Water Yield at Four Dependability Levels – West Banas Basin

Dependability Level, %	Water Yield, Mm^3
25	317.00
50	133.90
75	53.80
90	30.70
Mean	222.14

There are 14 micro-watersheds delineated in West Banas Basin within Rajasthan, virgin water yield of these micro-watersheds at four levels of 25, 50, 75 and 90% dependability is shown in Table 11.24.

Table 11.24: Virgin Water Yield at Four Dependability Levels – Micro-watersheds of West Banas Basin

Micro-watershed Code	Dependability Level, %				Mean
	25	50	75	90	
	Water Yield, Mm^3				
001	28.00	7.30	4.00	2.60	20.30
002	42.70	21.90	1.90	0.30	36.30
003	38.30	21.10	7.00	3.00	27.20
004	25.90	10.70	5.80	2.80	21.50
005	17.20	4.50	1.50	0.50	11.70
006	8.30	3.40	1.40	0.50	9.70
007	2.90	1.10	0.50	0.20	7.00
008	10.70	4.30	2.40	1.30	11.60
009	32.20	14.40	5.80	0.70	23.30
010	10.80	4.50	2.30	1.20	9.60
011	13.10	6.70	3.70	1.90	13.30
012	3.70	1.30	0.70	0.40	3.10
013	16.30	6.10	3.20	1.60	12.70
014	19.70	8.40	2.80	1.30	14.90

11.4.13 Sukli Basin

Rainfall occurs mainly during the monsoon season in Sukli Basin. Major portion of stream flow therefore occurs only during these months. Table 11.25 presents virgin water yield at different dependabilities for Sukli Basin. At 50% dependability level, the virgin water yield of Sukli Basin is 43.8 Mm^3 while at mean it is 137.6 Mm^3.

Table 11.25: Virgin Water Yield at Four Dependability Levels – Sukli Basin

Dependability Level, %	Water Yield, Mm^3
25	150.80
50	43.80
75	13.00
90	7.90
Mean	137.61

There are 11 micro-watersheds delineated in Sukli Basin, virgin water yield of these micro-watersheds at four levels of 25, 50, 75 and 90% dependability is shown in Table 11.26.

Table 11.26: Virgin Water Yield at Four Dependability Levels – Micro-watersheds of Sukli Basin

Micro-watershed Code	Dependability Level, %				Mean
	25	50	75	90	
	Water Yield, Mm^3				
001	4.20	1.50	0.50	0.30	4.20
002	10.80	3.70	1.30	0.80	9.80
003	20.50	5.90	2.50	1.30	18.60
004	33.40	11.90	2.60	1.50	29.90
005	18.40	7.50	2.50	1.40	17.30
006	18.80	3.10	1.10	0.60	16.40
007	12.70	1.70	0.20	0.10	11.50
008	6.10	1.00	0.10	0.00	6.00
009	12.10	1.50	0.20	0.10	10.20
010	9.40	4.50	2.10	1.20	9.40
011	4.40	0.60	0.00	0.00	4.20

11.4.14 Other Nallahs of Jalore Basin

Rainfall occurs mainly during the monsoon season in Other Nallahs of Jalore Basin. Major portion of stream flow therefore occurs only during these months. Table 11.27 presents virgin water yield at different dependabilities for Other Nallahs of Jalore Basin generated within Rajasthan. At 50% dependability level, the virgin water yield of Other Nallahs of Jalore Basin is 14.0 Mm^3 while at mean it is 51.4 Mm^3.

Table 11.27: Virgin Water Yield at Four Dependability Levels – Other Nallahs of Jalore Basin

Dependability Level, %	Water Yield, Mm^3
25	46.10
50	14.00
75	7.00
90	1.70
Mean	51.42

There are 9 micro-watersheds delineated in Other Nallahs of Jalore Basin within Rajasthan, virgin water yield of these micro-watersheds at four levels of 25, 50, 75 and 90% dependability is shown in Table 11.28.

Table 11.28: Virgin Water Yield at Four Dependability Levels for Micro-watersheds of Other Nallahs of Jalore Basin

Micro-watershed Code	Dependability Level, %				Mean
	25	50	75	90	
	Water Yield, Mm^3				
001	2.10	0.70	0.30	0.10	4.20
002	2.50	0.80	0.30	0.10	4.50
003	2.10	0.70	0.30	0.10	4.40
004	1.10	0.30	0.10	0.00	2.50
005	3.00	1.00	0.40	0.20	5.00
006	3.50	1.00	0.10	0.00	4.90
007	6.60	2.10	0.60	0.30	8.90
008	11.10	6.00	0.90	0.10	11.10
009	8.30	2.30	1.10	0.60	5.90

11.4.15 Ghaggar Basin

Rainfall occurs mainly during the monsoon season in Ghaggar Basin. Major portion of stream flow therefore occurs only during these months. Table 11.29 presents virgin water yield at different dependabilities for Ghaggar Basin generated within Rajasthan. At 50% dependability level, the virgin water yield of Ghaggar Basin is 3.1 Mm^3 while at mean it is 19.5 Mm^3.

Table 11.29: Virgin Water Yield at Four Dependability Levels – Ghaggar Basin

Dependability Level, %	Water Yield, Mm^3
25	31.60
50	3.10
75	1.30
90	0.60
Mean	19.54

There are two micro-watersheds delineated in Ghaggar Basin within Rajasthan, virgin water yield of these micro-watersheds at four levels of 25, 50, 75 and 90% dependability is shown in Table 11.30.

Table 11.30: Virgin Water Yield at Four Dependability Levels – Micro-watersheds of Ghaggar Basin

Micro-watershed Code	Dependability Level, %				Mean
	25	50	75	90	
	Water Yield, Mm^3				
001	8.20	1.80	0.70	0.40	6.60
002	15.60	0.90	0.40	0.10	13.00

11.4.16 Outside Basin

Rainfall in Outside Basin occurs mainly during the monsoon season. The major portion of stream flows therefore occurs during these months. As mentioned earlier, Outside Basin is divided into seven Sub-basins namely, Sub1, Sub2, Sub3, Sub4, Sub5, Sub6 and Fragmented. Table 11.31 presents virgin water yield at different dependabilities for Outside Basin. Annual virgin water yield at 50% dependability for Sub1, Sub2, Sub3, Sub4, Sub5, Sub6 and Fragmented Sub-basin is 28.9, 7.9, 149.1, 88.0, 80.6, 21.9 and 1.8 Mm^3, respectively. Annual virgin water yield at 50% dependability for Outside Basin is 644.0 Mm^3 (see Table 11.31).

Mean annual virgin water yield for Sub1, Sub2, Sub3, Sub4, Sub5, Sub6 and Fragmented Sub-basins is 86.1, 65.1, 318.5, 168.9, 192.7, 152.7 and 6.7 Mm^3, respectively. Mean annual virgin water yield for entire Outside Basin is 990.6 Mm^3.

Table 11.31: Virgin Water Yield at Four Dependability Levels – Outside Basin and its Sub-basins

Dependability Level, %	Sub1	Sub2	Sub3	Sub4	Sub5	Sub6	Fragmented	Outside Basin
	Water Yield, Mm^3							
25	96.70	79.10	428.90	200.30	264.50	51.80	5.60	1,623.00
50	28.90	7.90	149.10	88.00	80.60	21.90	1.80	644.00
75	8.50	2.10	34.50	31.70	26.50	9.80	0.70	288.00
90	1.00	0.80	11.50	15.50	12.30	5.40	0.30	119.90
Mean	86.07	65.07	318.49	168.88	192.68	152.72	6.68	990.60

There are 72 micro-watersheds delineated in Outside Basin, virgin water yield of these micro-watersheds at four levels of 25, 50, 75 and 90% dependability is shown in Table 11.32.

Table 11.32: Virgin Water Yield at Four Dependability Levels – Micro-watersheds of Outside Basin

Micro-watershed Code	Dependability Level, %				Mean
	25	50	75	90	
	Water Yield, Mm^3				
001	2.40	0.30	0.00	0.00	4.50
002	1.40	0.90	0.40	0.20	2.20
003	7.70	0.10	0.00	0.00	15.90
004	62.10	18.50	3.20	0.90	70.20

Micro-watershed Code	Dependability Level, %				Mean
	25	50	75	90	
	Water Yield, Mm^3				
005	3.90	1.20	0.10	0.10	5.20
006	61.20	3.40	1.40	0.80	59.90
007	20.00	4.10	0.00	0.00	18.50
008	6.40	1.80	0.40	0.00	12.80
009	9.50	3.00	1.10	0.90	25.60
010	4.40	1.30	0.40	0.30	10.70
011	7.10	1.90	0.20	0.10	7.20
012	15.50	3.20	1.00	0.60	45.40
013	20.60	3.60	0.50	0.10	14.90
014	18.20	2.10	0.50	0.30	11.70
015	37.20	10.70	3.00	2.00	38.20
016	17.40	2.90	0.40	0.10	12.40
017	13.60	0.80	0.30	0.10	11.40
018	25.60	8.50	1.60	0.30	18.70
019	10.10	3.30	1.20	1.00	26.10
020	76.00	13.40	1.00	0.60	58.90
021	1.10	0.20	0.10	0.10	1.50
022	4.50	0.90	0.10	0.00	4.50
023	1.70	0.80	0.30	0.20	2.30
024	7.90	2.60	1.00	0.50	10.10
025	4.50	1.70	0.70	0.30	5.60
026	10.90	3.00	1.40	0.70	18.20
027	54.30	18.20	5.30	1.70	39.30
028	2.70	1.20	0.60	0.30	3.50
029	28.30	1.40	0.70	0.40	27.80
030	4.00	1.30	0.30	0.20	3.30
031	1.60	0.60	0.20	0.10	3.10
032	53.70	14.20	3.00	2.00	55.70
033	1.40	0.80	0.50	0.30	2.60
034	1.10	0.60	0.30	0.20	2.10
035	2.80	1.20	0.60	0.30	5.20
036	21.20	5.30	1.40	0.30	14.70
037	61.90	8.30	2.00	1.00	70.90
038	6.70	1.00	0.50	0.30	19.40
039	16.30	2.40	1.10	0.90	9.90
040	11.90	0.50	0.10	0.10	11.40
041	1.60	0.60	0.40	0.20	6.10
042	1.80	0.90	0.60	0.30	3.60
043	0.90	0.50	0.30	0.10	2.70
044	5.70	0.10	0.10	0.00	8.70
045	22.90	4.20	0.40	0.30	14.10
046	10.30	0.90	0.30	0.20	21.20
047	1.90	0.80	0.50	0.20	2.70

Micro-watershed Code	Dependability Level, %				Mean
	25	50	75	90	
	Water Yield, Mm^3				
048	2.50	1.10	0.70	0.30	3.70
049	0.80	0.40	0.20	0.10	1.50
050	0.70	0.40	0.20	0.10	1.30
051	1.10	0.60	0.30	0.20	1.80
052	1.00	0.50	0.30	0.20	2.10
053	0.60	0.30	0.20	0.10	0.70
054	0.80	0.40	0.20	0.10	1.40
055	0.40	0.20	0.10	0.10	1.00
056	1.10	0.60	0.30	0.20	2.60
057	2.60	0.60	0.20	0.10	5.60
058	1.90	0.90	0.50	0.30	3.70
059	1.40	0.70	0.30	0.20	3.20
060	1.00	0.50	0.30	0.20	1.70
061	1.70	0.90	0.50	0.30	3.00
062	1.90	0.50	0.20	0.10	32.30
063	2.40	0.50	0.20	0.10	4.90
064	0.80	0.40	0.20	0.10	1.70
065	1.50	0.90	0.50	0.30	2.10
066	1.10	0.20	0.10	0.10	2.60
067	1.30	0.70	0.40	0.20	2.20
068	1.00	0.50	0.30	0.20	1.90
069	0.70	0.40	0.20	0.10	1.10
070	1.90	0.90	0.50	0.30	3.40
071	3.80	1.10	0.60	0.20	62.70
072	1.20	0.60	0.30	0.20	2.00

11.4.17 Summary of Basin-wise Virgin Surface Water Yield

Summary of basin-wise natural (virgin) surface water assessment is given in Table 11.33.

Table 11.33: Rajasthan State Natural (Virgin) Surface Water Yield, Mm^3

Property	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual	Variation
Shekhawati River Basin														
Mean	0.5	1.0	0.6	0.4	1.5	24.6	187.7	233.1	98.5	12.4	1.8	0.9	562.9	100.0%
90%	0.1	0.1	0.1	0.0	0.2	2.8	21.0	26.1	11.0	1.4	0.2	0.1	63.0	11.2%
75%	0.1	0.2	0.1	0.1	0.2	3.9	29.4	36.5	15.4	1.9	0.3	0.1	88.1	15.7%
50%	0.3	0.5	0.3	0.2	0.8	12.9	98.4	122.2	51.6	6.5	0.9	0.5	295.1	52.4%
25%	0.7	1.4	0.8	0.5	2.1	34.1	259.8	322.6	136.2	17.1	2.4	1.2	778.9	138.4%
Ruparail River Basin														
Mean	0.3	0.3	0.3	0.2	0.4	30.4	133.9	287.6	175.7	11.1	0.7	0.6	641.4	100.0%
90%	0.1	0.1	0.1	0.0	0.1	5.4	23.7	50.8	31.0	2.0	0.1	0.1	113.3	17.7%
75%	0.1	0.1	0.1	0.1	0.2	13.8	60.9	130.8	79.9	5.0	0.3	0.3	291.8	45.5%
50%	0.2	0.2	0.2	0.1	0.3	22.1	97.2	208.7	127.5	8.1	0.5	0.4	465.4	72.6%
25%	0.4	0.4	0.4	0.3	0.5	39.5	174.0	373.7	228.3	14.4	0.9	0.8	833.5	130.0%
Banganga River Basin														
Mean	5.6	3.6	3.1	1.9	3.5	13.9	96.8	225.4	203.9	129.6	51.4	16.3	754.8	100.0%

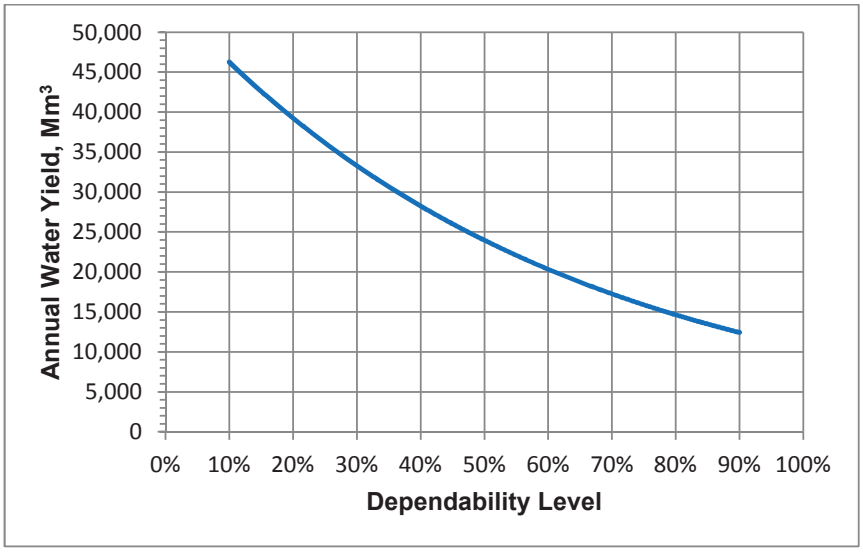
Property	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual	Variation
90%	1.3	0.9	0.7	0.5	0.8	3.3	23.1	53.8	48.6	30.9	12.3	3.9	180.0	23.8%
75%	2.1	1.4	1.2	0.7	1.3	5.3	37.1	86.3	78.1	49.6	19.7	6.2	289.0	38.3%
50%	4.2	2.7	2.3	1.4	2.6	10.4	72.3	168.3	152.2	96.8	38.4	12.2	563.5	74.7%
25%	8.0	5.1	4.4	2.7	5.0	19.9	138.3	322.0	291.3	185.1	73.4	23.3	1078.3	142.9%
Gambhir River Basin														
Mean	0.2	0.5	1.8	0.1	0.1	5.0	103.6	348.3	212.5	27.0	1.2	0.6	700.9	100.0%
90%	0.0	0.1	0.3	0.0	0.0	0.8	15.8	53.0	32.3	4.1	0.2	0.1	106.6	15.2%
75%	0.1	0.2	0.6	0.0	0.0	1.7	35.1	117.9	71.9	9.1	0.4	0.2	237.2	33.8%
50%	0.2	0.4	1.5	0.1	0.1	4.1	84.0	282.5	172.3	21.9	1.0	0.5	568.4	81.1%
25%	0.3	0.7	2.6	0.1	0.1	7.1	147.2	494.9	302.0	38.4	1.7	0.9	996.0	142.1%
Parbati River Basin														
Mean	0.2	0.8	0.6	0.0	0.0	6.6	76.9	191.0	126.3	21.1	1.7	2.1	427.2	100.0%
90%	0.1	0.3	0.2	0.0	0.0	2.3	26.7	66.4	43.9	7.3	0.6	0.7	148.6	34.8%
75%	0.1	0.4	0.3	0.0	0.0	3.6	42.4	105.3	69.7	11.6	0.9	1.2	235.6	55.1%
50%	0.2	0.7	0.5	0.0	0.0	5.9	68.4	169.9	112.4	18.8	1.5	1.9	380.1	89.0%
25%	0.3	1.1	0.8	0.0	0.0	8.9	103.5	257.0	170.0	28.4	2.3	2.8	574.9	134.6%
Sabi River Basin														
Mean	0.3	0.5	0.3	0.3	1.0	16.5	86.3	145.8	90.3	6.0	0.4	0.2	348.1	100.0%
90%	0.0	0.1	0.0	0.0	0.1	1.9	10.1	17.0	10.6	0.7	0.0	0.0	40.7	11.7%
75%	0.1	0.1	0.1	0.1	0.3	4.5	23.5	39.6	24.5	1.6	0.1	0.1	94.6	27.2%
50%	0.2	0.3	0.2	0.2	0.6	9.4	49.3	83.4	51.6	3.4	0.2	0.1	199.0	57.2%
25%	0.4	0.7	0.4	0.4	1.3	21.7	113.4	191.5	118.6	7.9	0.5	0.3	457.3	131.4%
Banas River Basin														
Mean	3.6	3.9	1.4	3.0	3.3	73.1	1680.1	2306.9	853.0	119.9	43.0	6.2	5097.3	100.0%
90%	1.7	1.9	0.7	1.4	1.6	34.8	799.4	1097.6	405.8	57.0	20.5	2.9	2425.2	47.6%
75%	2.3	2.5	0.9	1.9	2.1	46.8	1075.4	1476.6	546.0	76.7	27.5	4.0	3262.6	64.0%
50%	3.2	3.4	1.2	2.6	2.9	64.1	1474.0	2023.9	748.3	105.2	37.7	5.4	4471.9	87.7%
25%	4.9	5.3	1.9	4.1	4.5	99.4	2284.3	3136.5	1159.8	163.0	58.5	8.4	6930.4	136.0%
Chambal River Basin														
Mean	131.1	95.2	72.9	51.0	42.4	273.4	2803.9	3835.2	1926.4	713.6	327.0	217.7	10489.8	100.0%
90%	78.3	56.9	43.5	30.5	25.3	163.3	1674.7	2290.7	1150.6	426.2	195.3	130.0	6265.2	59.7%
75%	101.7	73.9	56.5	39.6	32.9	212.1	2175.6	2975.8	1494.7	553.7	253.7	168.9	8139.1	77.6%
50%	124.0	90.0	68.9	48.3	40.1	258.6	2652.1	3627.6	1822.1	675.0	309.3	205.9	9921.7	94.6%
25%	161.4	117.2	89.7	62.8	52.2	336.5	3451.2	4720.6	2371.1	878.4	402.5	267.9	12911.3	123.1%
Mahi River Basin														
Mean	2.3	1.1	0.8	0.6	1.3	77.1	1196.2	2253.9	1047.6	85.5	37.5	6.9	4710.9	100.0%
90%	1.1	0.5	0.4	0.3	0.6	38.2	591.9	1115.3	518.4	42.3	18.6	3.4	2331.2	49.5%
75%	1.5	0.7	0.5	0.4	0.8	50.0	775.5	1461.3	679.2	55.4	24.3	4.5	3054.2	64.8%
50%	2.0	1.0	0.7	0.5	1.1	67.4	1046.1	1971.1	916.2	74.8	32.8	6.0	4119.8	87.5%
25%	2.8	1.3	1.0	0.7	1.6	94.4	1465.0	2760.4	1283.0	104.7	45.9	8.5	5769.6	122.5%
Sabarmati River Basin														
Mean	0.5	0.4	0.3	0.4	0.9	8.7	115.4	313.9	257.4	30.4	3.3	1.1	732.5	100.0%
90%	0.1	0.0	0.0	0.0	0.1	1.0	13.6	37.1	30.4	3.6	0.4	0.1	86.6	11.8%
75%	0.1	0.1	0.1	0.1	0.2	1.9	24.6	66.9	54.9	6.5	0.7	0.2	156.2	21.3%
50%	0.3	0.2	0.2	0.2	0.6	5.4	72.1	196.0	160.7	19.0	2.1	0.7	457.4	62.4%
25%	0.6	0.5	0.4	0.5	1.1	10.7	142.1	386.4	316.9	37.4	4.1	1.4	901.7	123.1%
Luni River Basin														
Mean	0.8	1.5	0.5	1.9	4.5	37.4	662.0	935.6	588.2	26.7	9.5	1.3	2269.9	100.0%
90%	0.1	0.1	0.0	0.2	0.4	3.5	62.5	88.3	55.5	2.5	0.9	0.1	214.2	9.4%
75%	0.1	0.2	0.1	0.3	0.7	5.9	105.3	148.8	93.5	4.2	1.5	0.2	360.9	15.9%
50%	0.4	0.7	0.3	1.0	2.3	19.0	336.9	476.1	299.3	13.6	4.8	0.7	1155.1	50.9%
25%	1.1	1.9	0.6	2.4	5.8	47.6	842.5	1190.7	748.5	34.0	12.1	1.7	2888.9	127.3%
West Banas River Basin														
Mean	0.1	0.1	0.0	0.1	0.4	4.7	54.6	91.5	64.2	5.6	0.7	0.2	222.1	100.0%
90%	0.0	0.0	0.0	0.0	0.1	0.6	7.5	12.6	8.9	0.8	0.1	0.0	30.7	13.8%
75%	0.0	0.0	0.0	0.0	0.1	1.1	13.2	22.2	15.6	1.4	0.2	0.0	53.8	24.2%
50%	0.0	0.0	0.0	0.1	0.2	2.8	32.9	55.1	38.7	3.4	0.4	0.1	133.9	60.3%
25%	0.1	0.1	0.0	0.2	0.5	6.6	77.9	130.5	91.7	8.0	1.0	0.3	317.0	142.7%
Sukli River Basin														
Mean	0.1	0.1	0.0	0.1	0.1	2.1	25.4	56.1	45.8	5.5	1.8	0.5	137.6	100.0%
90%	0.0	0.0	0.0	0.0	0.0	0.1	1.5	3.2	2.6	0.3	0.1	0.0	7.9	5.7%
75%	0.0	0.0	0.0	0.0	0.0	0.2	2.4	5.3	4.3	0.5	0.2	0.0	13.0	9.4%
50%	0.0	0.0	0.0	0.0	0.0	0.7	8.1	17.8	14.6	1.7	0.6	0.2	43.8	31.8%

Property	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual	Variation
25%	0.1	0.1	0.0	0.1	0.2	2.3	27.9	61.5	50.2	6.0	2.0	0.6	150.8	109.6%
Other Nallahs of Jalore Basin														
Mean	0.0	0.1	0.0	0.0	0.0	0.4	15.9	22.7	11.0	0.7	0.5	0.1	51.4	100.0%
90%	0.0	0.0	0.0	0.0	0.0	0.0	0.5	0.8	0.4	0.0	0.0	0.0	1.7	3.3%
75%	0.0	0.0	0.0	0.0	0.0	0.1	2.2	3.1	1.5	0.1	0.1	0.0	7.0	13.6%
50%	0.0	0.0	0.0	0.0	0.0	0.1	4.3	6.2	3.0	0.2	0.1	0.0	14.0	27.2%
25%	0.0	0.1	0.0	0.0	0.0	0.4	14.3	20.4	9.9	0.6	0.4	0.1	46.1	89.7%
Ghaggar River Basin														
Mean	0.0	0.0	0.1	0.0	0.1	0.4	6.5	7.3	5.0	0.2	0.1	0.0	19.5	100.0%
90%	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.2	0.2	0.0	0.0	0.0	0.6	3.1%
75%	0.0	0.0	0.0	0.0	0.0	0.0	0.4	0.5	0.3	0.0	0.0	0.0	1.3	6.7%
50%	0.0	0.0	0.0	0.0	0.0	0.1	1.0	1.2	0.8	0.0	0.0	0.0	3.1	15.9%
25%	0.0	0.0	0.2	0.0	0.2	0.6	10.5	11.8	8.1	0.3	0.2	0.0	31.6	162.1%
Outside Basin														
Mean	1.0	1.8	1.0	1.2	4.5	76.3	328.5	293.0	191.6	80.9	4.0	6.8	990.6	100.0%
90%	0.1	0.2	0.1	0.1	0.5	9.2	39.8	35.5	23.2	9.8	0.5	0.8	119.9	12.1%
75%	0.3	0.5	0.3	0.3	1.3	22.2	95.5	85.2	55.7	23.5	1.2	2.0	288.0	29.1%
50%	0.7	1.2	0.7	0.8	2.9	49.6	213.6	190.5	124.6	52.6	2.6	4.4	644.0	65.0%
25%	1.6	2.9	1.6	2.0	7.4	125.0	538.2	480.1	313.9	132.5	6.6	11.1	1623.0	163.8%
Entire State														
Mean	146.5	110.9	82.7	61.1	64.2	650.5	7573.7	11547.2	5897.3	1276.2	484.5	261.4	28156.9	100.0%
90%	83.0	61.1	46.0	33.2	29.9	267.2	3311.9	4948.4	2373.5	589.0	249.7	142.4	12135.4	43.1%
75%	108.7	80.4	60.5	43.7	40.3	373.1	4498.4	6762.0	3285.2	801.1	331.0	187.9	16572.4	58.9%
50%	135.7	101.5	76.2	55.5	54.6	532.5	6310.6	9600.3	4795.9	1100.8	432.9	238.9	23436.2	83.2%
25%	182.5	138.8	103.4	76.7	82.6	854.6	9790.0	14860.6	7599.4	1656.3	614.3	329.1	36289.3	128.9%

Note: For details refer Final Report No. 4.2

Figure 11.1 presents the duration curve for the mean annual natural ('virgin') surface water yield for the entire state.

Figure 11.1: Entire State Natural (Virgin) Annual Surface Water Yield Dependability



11.5 Comparison of Current Study's Water Availability with Earlier TAHAL-WAPCOS Study (1998)

11.5.1 Introduction

The current study follows and updates the earlier one (Water resources Planning for the State of Rajasthan, TAHAL-WAPCOS, 1998), with the following main findings for surface water.

Natural (virgin) surface water availability was now simulated employing SWAT (Soil and Water Assessment Tool) model coupled with latest available GIS database and SRTM DEM of 90 m, while the earlier study employed the MRS (Monthly Runoff Simulation) model. The assessed basin-wise natural (virgin) surface water availability is given in Table 11.34.

The quoted values have been taken from the relevant current and earlier basin-wise appendix and relevant chapters, namely:

Sections 2 of basin appendices for surface water of Volume 2 of Final Report No. 4.2 for the current study, and Chapters 8 of earlier respective basin reports for surface water in the earlier study.

11.5.2 Natural (Virgin) Surface Water Availability Comparison

The Current to Earlier studies (C/E) comparison of simulated natural (virgin) surface water yield is given in Table 11.34.

Table 11.34: Current to Earlier (C/E) Comparison of Simulated Natural (Virgin) Surface Water Yield

S. No.	Basin	Basin Area, km^2			Mean Annual Virgin Water Yield, Mm^3		
		Current	Earlier	C/E	Current	Earlier	C/E
1	Shekhawati	9751	11522	0.85	563	221	2.55
2	Ruparail	4034	3855	1.05	641	210	3.05
3	Banganga	8583	8878	0.97	755	569	1.33
4	Gambhir	4694	4174	1.12	701	805	0.87
5	Parbati	1887	2388	0.79	427	226	1.89
6	Sabi	4524	4442	1.02	348	268	1.30
7	Banas	47060	45833	1.03	5097	4837	1.05
8	Chambal*	31243	79252	0.39	4801	24094	0.20
9	Mahi*	16611	25849	0.64	4711	7484	0.63
10	Sabarmati	4130	4164	0.99	733	960	0.76
11	Luni	69302	37363	1.85	2270	1224	1.85
12	West Banas	1831	1798	1.02	222	551	0.40
13	Sukli	990	947	1.05	138	190	0.73
14	Other Nallhas of Jalore	1900	1968	0.97	51	90	0.57
15	Ghaggar+Outside	135724	166464	0.82	1010	483	2.09
	Entire State	**342,264**	**398,897**	**0.86**	**22,468**	**42,212**	**0.53**

* Earlier Study values for Virgin Water Yield are considering catchment area outside Rajasthan.

After comparison of earlier 1998 study results with current study for natural (virgin) surface water availability some deviations were found which may be attributed to the reasons mentioned below:

- Rainfall used in both the studies are of different time scales. In 1998 study the rainfall duration was 1957-1993 while in present study the rainfall duration is from 1957-2010. Rainfall being a primary source of input for any hydrological modeling, change in its duration or characteristics will change the overall modeling output.
- The difference in catchment area considered also changes the overall water yield. In some cases like Chambal and Mahi where outputs were presented for entire catchment including areas outside Rajasthan boundary also.
- In case of Luni Basin in the present study the basin boundary has been modified which has resulted in increase in basin area (1.85 times).
- Hydrological model used in both the studies are different. In present study more advanced SWAT model is used for modeling. It is a physically based model. Rather than incorporating regression equations (as in earlier study where MRS model was used) to describe the relationship between input and output variables, SWAT requires specific information about weather, soil properties, topography, vegetation, and land management practices occurring in the catchment. The physical processes associated with water movement, sediment movement, crop growth, nutrient cycling, etc. are directly modelled by SWAT using this input data.
    - Benefits of this approach are
        - Catchments with no monitoring data (e.g. stream gauge data) can be modelled.
        - The relative impact of alternative input data (e.g. changes in management practices, climate, vegetation, etc.) on water quality or other variables of interest can be quantified using readily available inputs.
        - SWAT model is computationally efficient. Simulation of very large basins or a variety of management strategies can be performed without excessive investment of time or money.
        - The model enables users to study impacts on account of human interventions which makes it very suitable for scenario generation.
        - SWAT can handle complex watersheds.

SWAT model is widely accepted and being used by various National and International organizations.

Unlike previous study, this study aims at computing water balance components at much smaller scale (micro-watershed level). For this the consultants has computed water balance components for all unique micro-watersheds (MWS), and considering all micro-watersheds as separate entity the water yield is derived for entire catchment by adding contribution from all MWS within basin/sub-basin. For this exercise various fragmented portions of catchments along the Rajasthan boundary were grouped and results were computed on pro-rata basis for such areas. This exercise also induce some variation while computing the water yield and other components.

11.6 Storage Created in River Basins of Rajasthan

There are 24 major, 84 medium and 3,331 minor irrigation projects in 16 basins of Rajasthan (including Outside basin) as shown in table below.

Table 11.35: Existing Storage in River Basins of Rajasthan

Basin	Type of Project	No. of Projects	Live Storage Capacity, Mm^3
Shekhawati	Medium	1	8.32
	Minor	79	70.89
Total		**80**	**79.21**
Ruparail	Major	1	-
	Medium	1	24.92
	Minor	64	72.25
Total		**66**	**97.17**
Banganga	Major	1	73.58
	Medium	5	73.28
	Minor	196	233.61
Total		**202**	**380.47**
Gambhir	Medium	3	134.80
	Minor	113	102.93
Total		**116**	**237.73**
Parbati	Major	1	108.29
	Medium	2	44.53
	Minor	21	17.64
Total		**24**	**170.47**
Sabi	Medium	2	38.59
	Minor	70	87.92
Total		**72**	**126.51**
Banas	Major	9	1,426.56
	Medium	33	809.69
	Minor	1,302	1,204.74
Total		**1,344**	**3,440.99**
Chambal	Major	6	1,946.98
	Medium	22	631.44
	Minor	223	472.78
Total		**251**	**3051.20**
Mahi	Major	4	2,422.40
	Medium	2	45.77
	Minor	271	361.14
Total		**277**	**2,829.31**
Sabarmati	Minor	54	118.06
Total		**54**	**118.06**
Luni	Major	2	282.13
	Medium	11	260.36
	Minor	721	558.74
Total		**734**	**1,101.22**
West Banas	Medium	1	36.25
	Minor	25	46.43
Total		**26**	**82.68**
Sukli	Medium	1	25.58

Basin	Type of Project	No. of Projects	Live Storage Capacity, Mm^3
	Minor	16	35.54
Total		**17**	**61.12**
Other Nallahs of Jalore	Minor	30	**28.51**
Total		**30**	**28.51**
Ghaggar	-	-	-
Total		**0**	**0**
Outside	Minor	146	**37.74**
Total		**146**	**37.74**
State as a whole	Major	24	6,259.94
	Medium	84	2,133.53
	Minor	3,331	3,448.92
State Total		**3,439**	11,842.39

11.7 Impact of Water Haresting Structures (WHSs) on Major, Medium and Minor Irrigation Projects

11.7.1 Introduction

The high pressure on surface water, particularly upstream of existing catchment locations (storage reservoirs) seriously affected their purpose, with extreme case being Ramgarh Dam, which dried-up in consequence of upstream harvesting actions.

During the course of this study the Consultants have carried out detailed study of catchment areas of Major, Medium and Minor Irrigation Projects and studied the impact of WHSs on the project inflows, which has been presented in detail in Final Report No. 4.3.

11.7.2 Objective

This objective of the detailed study of catchment areas included:

- Catchment area demarcation of the projects.
- Identification of water harvesting structures constructed and the watershed works carried out (jointly denominated as WHSs) within the project catchments and marking them on GIS with hydrological details.
- Assessment of the impact of WHSs on inflows to the projects.
- Assessment of evaporation from these WHSs and Major, Medium and Minor projects and resultant water loss.
- Assessment of groundwater recharge from WHSs.
- Assessment of impact of WHSs on reservoir evaporation.
- Assessing water yield to projects at 25%, 50%, 75% and 90% dependability levels under with and without WHSs scenario, keeping all other interventions as same.
- Suggested future policy for construction of such water harvesting structures in major, medium and minor projects catchment.

11.7.3 Approach and Methodology

Approach and Methodology for the Major/Medium Projects Study:

- Delineation of project catchments using SRTM digital elevation model.
- Salient features of Project and its catchment to be indicated with respect to total area, topography, Land use, Soil etc.
- Identification of WHSs in individual project catchments and treating them as lumped ponds.
- Generating inflows to projects using SWAT hydrological model at 25%, 50%, 75% and 90% dependability.
- Assess the impact of WHSs on inflows to the projects
  - Scenario 1: With all interventions (including all upstream Major/Medium/Minor projects and WHSs)
  - Scenario 2: Excluding WHSs from Scenario 1.
- Evaluation of evaporation from all WHSs in project catchment.
- Evaluation of ground water recharge (in terms of sub-surface percolation) from all WHSs in project catchment.
- Assessment of net gain/loss to water yield of project after incorporating the WHSs.

Approach and Methodology for Minor Projects Study

There are 3,331 minor projects in Rajasthan state located across basins and sub-basins. Individual study of all such minor projects is not feasible to perform considering the scale, resources and input data. Consultants were suggested to come up with some methodology to assess the impact of WHSs on minor projects. The methodology adopted for minor project study is mentioned below.

Hydrological analysis based on the simulation outputs for minor projects is performed for those catchments which are devoid of Major/Medium projects. The impact of WHSs on the inflow to minor projects is analysed.

For assessing the impact of WHSs on inflows to the minor projects the hydrological model has been run with two scenarios, Scenario 1: Including WHSs and Scenario 2: Excluding WHSs.

Selection of minor projects are based on the criteria listed below:

- Those sub-basins which do not have Major/Medium projects but have minor projects.
- Minor projects present in the differential sub-basin area (without major/medium project) are lumped and treated as pond.
- Calibrated hydrological model SWAT was run for the two scenarios as mentioned above.

Effect of WHSs on water yield to minor projects is computed by taking difference of two scenarios.

Further, based on discussions it was also decided to study one individual minor project in defined river basins, for which the Consultant have adopted the same approach as in individual Major/Medium project study (see Appendix XII in Volume 2 of Final Report No. 4.3).

11.7.4 Major Outcomes of Detailed Catchment Areas Study

Overall study results indicate that these WHSs have moderate to considerable adverse impact on water yield to various projects. It is also observed that there are some unaccounted extractions happening in some project catchments which have drastically reduced the inflow to the project in past few years, classic example being the Ramgarh Dam catchment.

This study aims to assess the impact of water harvesting structures on water yield to various projects, recharge (in terms of sub-surface percolation) and evaporation from the same alongwith water yield at different dependabilities.

Evaluation of the impact of WHSs is a complex process since each water harvesting structure shall be getting filled up and then emptying out dictated by many natural processes such as rainfall, number of rain showers, contributing area at the structure, seepage rate, evaporation rate, etc. In the present case the distributed hydrological model (SWAT) is helping in keeping track of these complex situations in time and space and generating the results. It was observed, as per the above reasons, that the impact of WHSs on water yield received at the outlet does not have linear correlation with the WHSs capacity due to complex hydrological processes that are prevalent in a particular catchment. Therefore, the impact of WHSs should not be classified into cases of extent of entrapment in comparison to the capacity of the WHSs. The situation for the same catchment may change drastically on account of the rainfall distribution. The results of impact of WHSs should therefore be valid to the historical series in question.

It is also observed that impact on water yield (with and without WHSs) varies from year to year for the same catchment and comprises of values which are both greater than WHSs capacity and less than WHSs capacity depending on rainfall pattern.

Combination of several factors governs this complex hydrological process which may lead to non-linear relation of WHSs capacity with impact on water yield as mentioned below:

- Headwaters projects (with no upstream major/medium projects) with relatively smaller catchment and greater slope.
- Rainfall pattern, intensity and duration plays a crucial role in overall hydrology.
- Return flow from excess irrigation water (drawn from shallow aquifer which is continuously recharged by WHSs) will contribute to water yield at project site which affects the net yield.
- Filling of minor projects upstream may also have an impact on water yield at project site.
- Water yield to project is also affected by water imported for irrigation from other dams (command area irrigation).

- WHSs gets emptied quickly followed by another spell of rainfall which leads to refilling of WHSs multiple times in a particular year therefore in such cases the sum of recharge and evaporation will be higher than its storage capacity.
- Construction of excessive WHSs ignoring the rainfall pattern and virgin water yield of catchment.

Catchment area study of the major, medium and minor projects has been carried out and water yield at four dependability levels are computed alongwith study of impact of WHSs on water yield to project.

As mentioned earlier, WHSs data constructed upto year 2007 was available while additional WHSs constructed thereafter upto year 2010 were extracted from satellite images. Comparative analysis of WHSs constructed between year 2007 and 2010 (WHSs upto area of 2 ha were extracted from satellite images) is presented in Appendix 7 of this report.

A project has been classified as surplus if Water Yield at 75% Dependability exceeds its Gross Capacity; else it is classified as deficient. Overall basin wise summary of their respective major/medium projects has been presented in the following table.

Table 11.36: Basin wise Summary of Water Surplus and Deficient Major/Medium Projects

Basin	Number of Deficient Projects	Number of Surplus Projects	Total Number of Projects
Shekhawati	1		1
Ruparail	2		2
Banganga	6		6
Gambhir	3		3
Parbati	3		3
Sabi	2		2
Banas	41	1	42
Chambal	17	11	28
Mahi	4	2	6
Luni	13		13
West Banas	1		1
Sukli	1		1

It is observed that only 14 Major/Medium projects were found surplus namely Gambhiri of Banas Basin; Abhaypura, Bhimlat, Galwaniya, Gopalpura, Gudha, Harish Chandra Sagar, Jawahar Sagar, Parwan Lift, Parwan Pickup Weir, Parwati Pickup Wei and Ummed Sagar of Chambal Basin; Jakham and Surwania of Mahi Basin. Rest of the projects are classified as deficient as per above mentioned criteria. Within the deficient projects Ramgarh Dam, Kalakh Bund, Mata ji ka Khera, Chandra Bhaga, Phool Sagar Jalia, Girolia, Bisalpura are the ones which are badly affected due to upstream interventions.

11.7.5 General Conclusions drawn from the study

- WHSs have moderate to considerable adverse impact on water yield of projects.
- In almost all the project catchment analysis it is observed that water yield has reduced after construction of these WHSs.
- The WHSs helps in recharging of groundwater, a portion of which contributes to stream as return flow.
- With no WHSs in place the water yield to projects gets increased thereby increasing the reservoir evaporation.
- It is observed in many project catchments that excessive construction of minor projects jeopardize the design yield of downstream project. In addition to these minor projects, there are huge number of WHSs constructed which again aggravates the situation.
- The net water harnessed at project is more when WHSs has not been constructed.
- Due to unaccounted extractions and encroachments on river beds the inflow to dams has been adversely affected.
- Most of the projects are not receiving water as per designed volume.
- Construction of WHSs reduces the evaporation losses from the Major/Medium projects, which is considered as a loss to system.

11.7.6 Policy for future development of WHSs

There cannot be a single policy for future development of WHSs which can be applied to all basins of Rajasthan. However, policy makers should consider some points before making a decision which are mentioned below:

- It is observed that in many project catchments the overall storage capacity of minor projects and WHSs exceeds the design capacity of project downstream. In such cases, no more development of WHSs or minor projects should be undertaken.
- WHSs should only be constructed in the project catchments where surplus water is available, considering its effect on downstream dam.
- New WHSs can be constructed in the areas outside existing project catchments that too keeping in mind the virgin water yield of the basin/sub-basin.
- WHSs should be constructed with a clear objective in mind such as:
    - provide drinking water facilities in the villages along both the sides of the river after monsoon period.
    - Groundwater recharge.
    - To provide incidental irrigation during late Kharif and Rabi by storing water at the end of monsoon mainly through lifting devices.
    - Irrigation use of water flowing down drainage channels.
    - To divert water from perennial / semi-perennial streams in hilly areas for irrigation purpose.
    - Other uses by villagers like bathing, livestock water consumption, recreation etc. depending on location and potential.
    - WHSs does have an adverse impact on inflow to downstream project thus the priority should be well defined as to whether localised groundwater

recharge and other water use is of priority at expense of inflow to downstream project.

11.7.7 Recommendations

On Construction of WHSs

- The WHSs should only be constructed in catchments of existing projects where the yield is surplus, that too considering its effect on downstream dam.
- The encroachments on river beds should be checked.
- Reservoir operations and water account should be recorded regularly in time series format.
- Any sought of development in the catchment should be monitored and checked such as illegal groundwater extraction, change in cropping intensity, number of additional WHSs constructed, etc.

On Reservoir data and project catchment information

- Reservoir operation data like date of release of water, its quantity etc should be monitored and data should be scrutinized and stored electronically for easy access and use.
- Volume of water spilled should be properly measured.
- Any illegal abstractions should be checked and monitored.
- There should be a mechanism to accurately measure inflow to the dams by proper water accounting. A standardized format should be developed to keep record of all water balance components (inflow, releases, spills, evaporation etc.) at reservoir as it is monitored and stored in projects like Jakham Dam, Kota Barrage, Jawahar Sagar Dam etc.
- Evaporation at each reservoir site should be measured by installing Evaporation pan.
- Gauge-Capacity curve should be updated.
- The observed capacity data should be cross checked with the average amount of rainfall occurred over the region to validate the data.

12. Imported Surface Water

12.1 General

In addition to its own-originating surface water runoff, Rajasthan receives imports of water flowing in from other States. From the point of view of nature, such imports materialise in the following manners:

- Water delivered by means of canals/feeders ('Canal' Types);
- Shared contributing river basins ('Shared' types);
- Tail reaches of upstream utilised river basins ('Tail' types).

Areas that lie along the State's boundaries utilise the imported water, under the following schemes:

- North of Outside Basin (including Ghaggar Basin) Scheme comprises several sub-schemes, as follows:
  - Bhakra, Gang, Nohar-Sidhmukh ('Canal' type);
  - IGNP (Indira Gandhi Nahar Project, 'Canal' type);
  - Ghaggar ('Tail' type);
- Gurgaon Canal and Bharatpur Canal Schemes, utilising Rajasthan's share of Yamuna River ('Canal' type);
- Chambal River Basin Scheme ('Shared' type);
- Mahi River Basin Scheme ('Shared' type);
- Narmada Scheme ('Canal' type).

This Section of the report describes water import schemes that deliver water through dedicated canals. The various schemes are shown in Surface Water Key Map given at the end of the report. The aspect of Imported Surface Water Availability has been presented in detail in Volume 1 and Volume 2 of Final Report No. 4.2.

Shared basins, namely: Chambal and Mahi, are extensions of basins that originate outside of Rajasthan, but also have considerable catchment area of tributaries that take off in Rajasthan and therefore are treated as 'within-State surface waters'.

Rajasthan's Ghaggar basin is a combined case with major flood/surplus inflow from adjacent Punjab and Haryana States, in addition to a small own contribution.

Several inter-state agreements administer the supply to Rajasthan of water from external sources, viz:

- Water in Gang canal, according to an old agreement between the erstwhile rulers of Bikaner State and Punjab;
- Water in Bhakra canal system, according to Bhakra Nangal agreement;

- Water in Indira Gandhi Canal system, according to agreement on sharing of surplus Ravi-Beas waters;
- Water in Gurgaon Canal and Bharatpur Feeder in Bharatpur district, according to the agreement on sharing Yamuna River water;
- Water in Chambal River system, according to an agreement between Madhya Pradesh and Rajasthan;
- Water in Mahi River system, according to agreement between Gujarat and Rajasthan;
- Water in Narmada Canal system of Rajasthan, according to agreement on sharing Narmada River water.

According to existing inter-State agreements, Rajasthan has the following share in out-of-State rivers:

- Ravi-Beas-Sutlej: 13,716 Mm^3/yr imported to Ghaggar and Outside Basin; utilised in IGNP, Bhakhra, Sidhmukh-Nohar and Gang projects.
- Yamuna: 1,119 Mm^3/yr presently partly utilised in Ruparail and Banganga Basin (through Gurgaon Canal and Bharatpur Feeder); utilisation in Banganga to be increased, and additional water to be utilised in the Outside Basin (in Churu and Jhunjhunu District).
- Mahi: Presently 454 Mm^3/yr but 1,920 Mm^3/yr was agreed (in the year 1966) for Rajasthan after implementation of the Sardar Sarovar Project in Gujarat.
- Chambal: 1973 Mm^3/yr was agreed as Rajasthan's share upto Kota Barrage between Madhya Pradesh and Rajasthan.
- Narmada: 617 Mm^3/yr imported to Luni and Other Nallahs of Jalore Basin through the Narmada Canal.

The details of the related inter-State agreements is given in Table 12.1.

Table 12.1: Inter-State Agreements related to Imported Surface Water

River	Allocated Share		Date of Agreement	Parties to the Agreement
	Maf/yr	Mm^3/yr		
1. Canal/Feeder Import				
1.1 Ravi-Beas-Sutlej Systems				
Ravi Beas (pre-partition)	1.11	1,369	04.09.1920	British Govt., Nawab of Bhawalpur & Maharaja of Bikaner
Ravi Beas	8.60	10,608	31.12.1981	Haryana, Punjab & Rajasthan
Sutlej	1.41	1,739	13.01.1959	Punjab & Rajasthan
Sub-total	**11.12**	**13,716**		
1.2 Yamuna System	0.91	1,119	12.05.1994	Delhi, Himachal Pradesh, Haryana, Rajasthan & Uttar Pradesh
1.3 Narmada System	0.50	617	07.12.1979	Gujarat, Maharashtra Madhya Pradesh & Rajasthan
Total Canal/Feeder Import	**12.53**	**15,452**		
2. Shared River Basin				
Chambal	1.60	1,973		Madhya Pradesh & Rajasthan

River	Allocated Share		Date of Agreement	Parties to the Agreement
	Maf/yr	Mm³/yr		
Mahi	0.37	454	10.01.1966	Gujarat & Rajasthan
Total Shared River Basin	**1.97**	**2,427**		
3. River Tail (without formal agreement)				
Ghaggar	0.40	489		Spontaneous flows

Source: WRD

In addition, tail water of Ghaggar River at an average of 489.07 Mm^3/yr is available in Rajasthan, which can be considered as imported water in Hanumangarh district of the State. Rajasthan also claims additional shares of water from Chambal and Mahi Rivers and efforts are also being made by the State to have Ganga waters as given in Table 12.2.

Table 12.2: Claimed Share in Inter-State Waters

River	Claimed Share	
	Maf/yr	Mm³/yr
Chambal	2.85	3,520
Mahi	1.54	1,900
Sharda-Yamuna	2.14	2,640
Ganga [1]	2.22	2,736
[2]	37.13	45,800
Total [1]	**8.75**	**10,796**
[2]	**43.66**	**53,860**

[1] Studied by NWDA
[2] Requested by Rajasthan

Concise description of the concerned schemes are described below, based on 'Rajasthan – Interstate Waters" report prepared by the Government of Rajasthan, Water Resources Department, February 2012, and other studies performed by the Consultants (TAHAL-WAPCOS) on water resources plans of Rajasthan, as well as Haryana and Gujarat States.

Compared with the Earlier 1994-1998 study, the definite rights, need and role of water imports have not been altered in the Current study, hence no comparison is needed.

12.2 Outside Basin (including Ghaggar Basin) North Schemes

12.2.1 Ravi-Beas-Sutlej (RBS) Waters

Rajasthan forms part of the Indus Basin which originates in Tibet at an elevation of 5,182 m amsl. The total length of the Indus river from its source to the sea is 2,880 kms, out of which about 1,1140 kms lie in India, with catchment area up to the India-Pakistan border of 168,335 km^2. Its relevant tributaries in India are Ravi, Beas and Sutlej.

Ravi River originates near Rohtang Pass in Kangra district and drains the southern slopes of the Dhauladhar. After crossing the Shiwaliks, it enters the

Punjab plains at Madhopur. From its source to the India-Pakistan border, the river has a length of about 370 kms.

Beas River originates from the southern face of Rohatang Pass at an elevation of 4,062 m asl. Fairly steep in its upper portion (24 m/km) it flows lower down in a westerly course through hilly country. On meeting the Shiwalik hills in Hoshiarpur, the river sweeps sharply northward, then, bending round the base of the hills, it takes a southerly direction. Lower down, the river meanders from year to year through the alluvial valley and finally joins the Sutlej River at Harike after a total course of 460 kms, wholly in India.

Sutlej River takes off in the distant highlands of Tibet at an elevation of about 4,570 m asl from Mansarowar Lake. It has a very long course through the mountain ranges that rise to 6,100 m on either side. It passes through Himachal Pradesh and then enters Punjab in Hoshiarpur district. The river emerges from the Shiwalik hills at Bhakra gorge and flows in a narrow deep stream with low hills on either side for about 16 kms before it widens into an alluvial river. It receives the Beas River at Harike above Ferozepur before joining the Chenab at Madwala in Pakistan. From Mansarowar lake to the India-Pakistan border, the river has a length of 1,078 kms and a catchment area, excluding that of Beas river but including the head reach in Tibet, of 2,014,058 km^2.

Several agreements relate to the shared use of these rivers as given in Rajasthan – Interstate Waters, Government of Rajasthan, Water Resources Department, February 2012.

12.2.2 Gang Canal System

Gang Canal project was first prepared in 1917, and later revised in 1920 and 1922. It envisaged a canal with full supply capacity of 60.71 m^3/sec (2144 cusecs), with a bottom width of 27.74 metres (91 ft), intended to extend irrigation benefits to a gross area of 305,500 ha (755,000 acres.) with a CCA of 263,300 ha (650,588 acres). Canal construction started in 1922 and was completed in April 1928. The canal in its reach in Punjab, and up to Shivpur Head, where it bifurcates into Feeder Canal and Laxminarayanji Branch canal, is lined with lime concrete. The Punjab portion of the canal is called Bikaner Canal, and in Rajasthan - Gang Canal.

Soon after construction of the canal it was realised that some additional supplies could be available during the Kharif period, and the Authorised Full Supply discharge was accordingly increased to 77 m^3/sec (2720 cusecs) from April 1935. Two non-perennial (NP) canals, the Lalgarh NP and Sameja NP, were added, increasing the CCA by 40,000 ha (98,800 acres). The total CCA thus covered was 303,260 ha (749,388 acres). With the subsequent inclusion of some additional command, the CCA under the Gang canal became 307,550 ha (760,00 acres). The gross command area (GCA) is 443,000 ha.

The intensity of irrigation as planned was 62.5% - 26.5% in Kharif and 36% in Rabi. The planned water allowance was 0.18 l/sec/ha (2.56 cusecs per 1000 acres) for the perennial canals, 0.358 l/sec/ha (5.12 cusecs per 1000 acres) for

Lalgarh NP and 0.27 l/sec/ha (3.84 cusecs per 1000 acres) for Sameja NP canal. The intensity of irrigation was subsequently reduced to 60%, with 24% in Kharif and 36% in Rabi. The pre-Partition use of water by Gang Canal was 1.37 Bm^3 (1.11 MAF), based on mean annual supplies in the Indus Basin rivers. Subsequently, with the allocation of surplus Ravi - Beas waters of 10.69 Bm^3 (8.6 MAF) for Rajasthan, Gang Canal was allowed 0.41 Bm^3 (0.33 MAF) in addition to its pre-Partition share, and use, thus bringing the total allocation to the Gang canal system, based on mean year supplies, to 1.78 Bm^3 (1.44 MAF). By the year 1984 Gang Canal system achieved an irrigation intensity of 42% in Kharif and 48% in Rabi (total 90%), and this increased to more than 100% during 1990-95.

The canal was originally designed as a lined canal, with Kankar lime (nodular hydraulic) concrete in the Punjab as well as the Rajasthan portion, with a full supply depth (FSD) of 2.4 m (8 ft). The FSD was later raised to 3.0 m (9.9 ft), to take care of the increased discharge of 77 m^3/sec (2720 cusecs). The FSD was again raised to 3.38 m (11.1 ft) in 1975 to ensure flow of the authorised full supply of 77 m^3/sec (2720 cusecs).
A portion of the feeder canal in Rajasthan, and all distributaries and smaller channels, were designed and constructed as unlined channels. The lime concrete lining of the main Bikaner canal started deteriorating with the passage of time, causing a substantial reduction in the canal capacity. Against 74.75 m^3/sec (2640 cusecs), the discharge received at the State border was only 60.88 m^3/sec (2150 cusecs) in the early eighties, and has been gradually reducing every year thereafter.

The deteriorated condition of the lining not only affected the carrying capacity of the canal but also resulted in heavy seepage losses through the sandy embankments, affecting both sides of the canal with a rise in the subsoil water level. Higher subsoil water levels created back- pressure on the lining during periods of annual closure, resulting in collapse of the lining membrane in several reaches. It became necessary to plan a complete renewal and re-sectioning of Bikaner Canal. The planning had to be such that the existing irrigation from the canal system would not be disturbed during the execution of the proposed reconditioning of the canal, which would take a few years to complete.

To ensure continuity of supply in the existing irrigation system it was proposed to bring water to Gang Canal area by constructing an unlined Link Channel, branching from Rajasthan Feeder at RD 491500, close to Rajasthan border, to join Gang Canal at its RD 3200, downstream of Shivpur Head Regulator, thus enabling re-lining and re-sectioning of Bikaner Canal without disturbing the present irrigation.

12.2.3 Bhakra Canal System

372,300 ha (920,000 acres) of Rajasthan area were included in the CCA of Bhakra Canal, starting from Nangal Head Works, upstream of Ropar. The planned intensity of irrigation was 26% in the Kharif season and 36% in the Rabi season. The areas commanded by the canal system of Bhakra Nangal Project were classified into three zones, based on climatic and sub-soil ground

water level conditions: restricted perennial (Zone I), non-perennial (Zone II) and perennial (Zone III). Water allowances and intensity of irrigation in the command area were fixed according to this classification.

Considering all the existing and new areas, the total CCA under Bhakra Canal system amounts to 3,880,827 ha (9,585,644 acres), out of which the CCA in Rajasthan is 372,300 ha, all of which was classified as perennial (Zone III), to be irrigated at 62% intensity. This area in Rajasthan is under the command of different branches and distributaries of Bhakra Main Line, which has an extensive distribution system in Punjab and Haryana.

Rajasthan receives its share of supplies at the following five points:

	Contact	CCA		Discharge		Branch
	Point	×100,000 acres	×1,000 ha	cusecs	m^3/sec	System
1	Tail of Sirhind Feeder	5.87	237.5	1610	45.59	Sadul and Karnisigh
2	Tail of Jandwala Dsty.	0.79	32	255	7.22	Khara Sub-branch
3	Tail of South Ghaggar	0.98	39.7	266	7.53	Ghaggar Sub-branch
4	Tail of Baruwali Dsty.	0.39	15.8	106	3	Jasana System
5	Tail of Kishangarh Br.	1.17	47.3	355	10.05	Amarsigh Sub-Br.
	Total	**9.2**	**372.3**	**2592**	**73.39**	

The distribution and delivery of water to Rajasthan area is governed by the Bhakra Nangal Agreement between the erstwhile State of Punjab (now Punjab and Haryana) and the State of Rajasthan, signed in 1959. Under this agreement Rajasthan is a partner in Bhakra Nangal Project and is entitled to receive 15.22% of both stored water supply and power generated. However, Rajasthan's actual share of water in the filling and emptying period of Bhakra Dam is about 11% only, because an allowance had to be made to pre-Bhakra supplies to the already existing irrigation systems under command of Sirhind and Bisht Doab Canals, which had a preferential right over Sutlej water and had to be assured uninterrupted supplies. Under Bhakra Nangal Agreement the total allocation of water to Rajasthan was 1,837 Mm^3 (1.49 MAF). Rajasthan could however be allocated additional 259 Mm^3 (0.21 MAF) for this system out of its share of 10,608 Mm^3 (8.6 MAF) in the surplus Ravi and Beas waters. Thus the total annual allocation for Rajasthan in this system is 2,096 Mm^3 (1.70 MAF), out of the total allocation of 13,716 Mm^3/yr to Rajasthan from the Ravi - Beas - Sutlej system of rivers.

12.2.4 Nohar-Sidhmukh System

The following works have been carried out under this project in Haryana and Rajasthan:

a. In Haryana

Construction of three lined feeder canals from Tohana Headworks, including:

1) Sidhmukh and Nohar Feeder, 49 km long, with a carrying capacity of 23.5 m^3/sec (829 cusecs), running parallel to the existing Fatehabad Branch, starting from the tail end of BML canal;
2) Sidhmukh Feeder, 38 km long, with a carrying capacity of 16.0 m^3/sec (564.34 cusecs), running parallel to the existing Kishangarh Sub-Branch, starting from the tail end of Sidhmukh and Nohar Feeder for Sidhmukh command area;
3) Nohar Feeder, 73 km long, with a carrying capacity of 6.25 m^3/sec (220.66 cusecs), running parallel to the existing Baruwali Distributary, starting from the tail end of Sidhmukh and Nohar Feeder, for Nohar command area.

b. In Rajasthan

1) Construction of Sidhmukh Feeder, parallel to Amarsigh Sub-Branch and Jansal, Raslana and Sidhmukh Distributaries;
2) Construction of a canal system in Hanumangarh and Churu Districts. The total CCA covered in the two districts is 114,119 ha.

12.2.5 Indira Gandhi Nahar Project (IGNP)

The origin of this canal is from Harike barrage located in Punjab. Indira Gandhi Feeder has a length of 204 kms, of which 170 kms length is in Punjab and Haryana and the remaining 34 kms in Rajasthan. In Rajasthan, this canal enters at Hanumangarh. Indira Gandhi Main Canal, with a length of 445 kms starts from the tail of Indira Gandhi Feeder, which passes through Shri Ganganagar and Bikaner districts and ends at Mohangarh in Jaisalmer.

For administrative convenience, the project has been divided in two stages. The 393 kms long canal portion form Harike barrage to Pugal (Bikaner district), i.e. up to RD 620 with its distribution system (excluding Sahwa lift) is called Stage-I. Most of the work of this stage has already been completed and the maximum portion of this stage (except Kanwar Sain lift) has been transferred to the Water Resources Department for operation and maintenance.

As reported, work on Stage-II of IGNP was under progress in the year 2011. The area downstream to RD 620 of the Main Canal with its distribution system (including Sahwa lift) is in Stage-II. The length of main canal in this stage is 256 kms, which extends from Pugal to Mohangarh. Work on the main canal was completed in 1986. The total cultivable command area (CCA) of the project was envisaged at 19.63 lakh ha (5.53 lakh ha in Stage-I + 14.10 lakh ha in Stage-II) but since Punjab is not releasing 0.60 Maf water of Rajasthan's share (8.6 Maf), and since the demand for drinking water, etc. has increased, the State Government in the year 2005 took a decision to complete the canal construction work in 16.17 lakh ha cultivable command area (excluding 0.50 lakh ha area opened for irrigation in Shahgarh area of Jaisalmer, which is being acquired by the Army). Out of this, 15.93 lakh ha (5.46 lakh ha in Stage-I + 10.47 lakh ha in Stage-II) has been opened for irrigation up to March 2011. Therefore 0.24 lakh ha area is the balance to be opened for irrigation in Stage-II for which construction works in Baba Ramdev (Gadra Road) sub-branch and three lift schemes are under progress. In year 2011 it was proposed to open 2,500 ha

cultivable command area after completing all works in this area out of which 670 ha CCA has been opened up to December 2011.

For efficient and optimum use of the available water in the project, it was proposed to establish sprinkler irrigation system in the lift schemes of Stage-II. A pilot project in 27,449 ha area was taken up and has almost completed in 25,419 ha area. Constitution of 23 Water User Associations (WUA) has been done out of total 25 WUA proposed in this area, and irrigation by sprinkler has been installed in 11,488 ha after establishing electric connections. Provision of sprinkler works has been included in the Revised Project estimate of Stage-II prepared in year 2010, which has been approved by the Central Water Commission and the Planning Commission in the year 2011. The total cost of the works of Stage-II according to this estimate was Rs 6,921.32 crore. Cost of works excluding water courses is Rs 5,887.56 crore, out of which Rs. 3,316.38 crore has been spent up to March 2011. Total expenditure on Stages I and II of the project up to March 2011 was Rs 3,812.92 crore.

Apart from sprinkler irrigation, SCADA system has also been installed in the project for effective control on water regulation and distribution in canals through latest techniques. The quantity of water flowing in the Main canal and other important canals off-taking from this, is available at the main controlling points of the project. This is also available on internet. Apart from this, work of automation of gates of the main canal is also under progress. On completion of Stage-II, 37 Lakh ton agricultural production is expected from the whole project. Forest development, pasture development and sand dunes stabilization are other important aspects of this project.

Apart from irrigation, water for drinking purpose is also being supplied in the entire command area. From Kanwar Sain lift of Stage-I, water is being provided to Bikaner City and 99 villages which are outside the project and from Gandheli Sahwa lift, 175 villages of Churu district are receiving water. Jodhpur city and en-route villages are getting water from this project through Rajeev Gandhi lift canal. Jaisalmer city, Ramgarh and many villages are also getting water from canal. Supply of water from Gajner lift to Nagaur town has also started.

After completion of the project, water will be made available to about 1.80 Crore population in 8 districts in western Rajasthan along with industries and power plants. A total 1,200 cusecs of water has been reserved for this purpose.

12.2.6 Water Utilization

Rajasthan share in Ravi-Beas-Sutlej, amounting to 13,716 Mm^3/yr, has the following break up:

-	Pre-partition rights in Gang Canal waters	1,369 Mm^3
-	Allocation from Ravi and Beas surplus waters	10,608 Mm^3
-	Sutlej waters through Bhakhra Canal	1,739 Mm^3
	Total	**13,716 Mm^3**

To assess the availability of imported water at different levels of dependability, the Consultants have analysed information pertaining to the relevant rivers,

dams and diversions, as detailed in respective Sections. Table 12.3 summarises the findings of these studies.

Table 12.3: Water Availability of North Outside Basin (including Ghaggar Basin) Scheme, Mm^3/yr

Source	Mean	25%	50%	75%	90%
IGNP Stage I	4,428	6,018	4,132	3,110	2,645
IGNP Stage II	4,934	6,698	4,598	3,461	2,944
Gang Canal	1,776	1,910	1,740	1,650	1,610
Bhakhra Canal	1,998	2,138	2,020	1,836	1,607
Sidhmukh-Nohar Canal Areas	580	621	586	533	466
Total	**13,716**	**17,385**	**13,076**	**10,590**	**9,272**

The combined use of Rajasthan in Ravi, Beas and Sutlej Rivers is given in Table 12.4.

Table 12.4: Combined Use of Ravi, Beas and Sutlej Rivers Water in Rajasthan

System	Water Use		CCA, Lakh ha	
	Maf	Mm^3	Allocated	Present
Gang Canal	1.44	1,776	3.08	3.14
Bhakra Canal	1.62	1,998	3.61	3.61
IGNP	7.59	9,362	19.63	15.93
Sidhmukh Nohar	0.47	580	1.12	
Total	11.12	13,716	27.44	22.68

Rajasthan is using Ravi-Beas-Sutlej waters for irrigation and domestic consumption in the districts of Ganganagar, Hanumangarh, Bikaner, Jodhpur, Jaisalmer and Barmer by means of Gang, Bhakra and Indira Gandhi Canal projects, as follows:

- The water of Gang canal is received from Ferozepur Feeder, off-taking from Harike Barrage.
- The water for Bhakhra project is received from Nangal Barrage on Sutlej River.
- The water for IGNP canal is received from Harike Barrage located on Beas River.

Rajasthan is at the tail end of all these canal systems and the States in upper reaches pass shortages of water over to Rajasthan, especially during peak agricultural demand periods, and consequently the irrigation in Rajasthan suffers.

Water use statement by BBMB for basin state share account of Ravi-Beas and Sutlej Rivers are given in Table 12.5 and Table 12.6 respectively.

Table 12.5: Abstract of Basin States Share Account of Ravi Beas Water as maintained by BBMB (in Maf)

Period & Year	Punjab				Rajasthan				Haryana			
	Share	Share limited to indent	Deliveries	Excess/ shortage	Share	Share limited to indent	Deliveries	Excess/ shortage	Share	Share limited to indent	Deliveries	Excess/ Shortage
1	2	3	4	5	6	7	8	9	10	11	12	13
2002-03												
Filling	2.120	2.120	3.334	1.214	1.900	1.900	2.190	0.290	0.597	0.431	0.418	-0.013
Depletion	2.475	2.375	2.652	0.277	2.969	2.969	3.751	0.782	1.014	0.991	0.958	-0.033
Total	4.595	4.495	5.986	1.491	4.869	4.869	5.941	1.072	1.611	1.422	1.376	-0.046
2003-04												
Filling	2.590	2.590	4.040	1.450	2.666	2.530	2.713	0.183	0.926	0.610	0.497	-0.113
Depletion	2.664	2.505	3.216	0.711	3.280	3.280	3.991	0.711	1.146	1.088	1.087	-0.001
Total	5.254	5.095	7.256	2.161	5.946	5.810	6.704	0.894	2.072	1.698	1.584	-0.114
2004-05												
Filling	2.111	2.111	3.151	1.040	1.884	1.884	1.585	-0.299	0.591	0.525	0.518	-0.007
Depletion	2.686	2.080	3.112	1.032	3.399	3.393	4.048	0.655	1.212	1.212	1.059	-0.153
Total	4.797	4.191	6.263	2.072	5.283	5.277	5.633	0.356	1.803	1.737	1.577	-0.160
2005-06												
Filling	2.843	2.776	3.865	1.089	3.079	2.931	2.993	0.062	1.103	0.791	0.698	-0.093
Depletion	3.008	2.731	3.177	0.446	4.058	4.024	4.781	0.757	1.494	1.409	1.326	-0.083
Total	5.851	5.507	7.042	1.535	7.137	6.955	7.774	0.819	2.597	2.200	2.024	-0.176
2006-07												
Filling	2.441	2.401	3.279	0.878	2.423	1.953	2.520	0.567	0.822	0.518	0.430	-0.088
Depletion	2.876	2.409	2.904	0.495	3.907	3.906	5.149	1.243	1.420	1.385	1.352	-0.033
Total	5.317	4.810	6.183	1.373	6.330	5.859	7.669	1.810	2.242	1.903	1.782	-0.121
2007-08												
Filling	2.850	2.796	3.681	0.885	3.091	3.091	3.082	-0.009	1.108	0.949	0.758	-0.191
Depletion	2.629	2.543	3.194	0.651	3.224	3.210	3.650	0.440	1.122	1.122	1.040	-0.082
Total	5.479	5.339	6.875	1.536	6.315	6.301	6.732	0.431	2.230	2.071	1.798	-0.273
2008-09												
Filling	2.294	2.175	3.109	0.934	2.183	1.995	2.150	0.155	0.719	0.541	0.486	-0.055

Period & Year	Punjab				Rajasthan				Haryana			
	Share	Share limited to indent	Deliveries	Excess/ shortage	Share	Share limited to indent	Deliveries	Excess/ shortage	Share	Share limited to indent	Deliveries	Excess/ Shortage
1	2	3	4	5	6	7	8	9	10	11	12	13
Depletion	3.200	2.467	2.829	0.362	4.158	4.157	5.447	1.290	1.523	1.429	1.399	-0.030
Total	5.494	4.642	5.938	1.296	6.341	6.152	7.597	1.445	2.242	1.970	1.885	-0.085
2009-10												
Filling	2.058	2.002	2.990	0.988	1.797	1.797	1.717	-0.080	0.553	0.409	0.347	-0.062
Depletion	2.207	2.114	2.760	0.646	2.536	2.536	2.440	-0.096	0.828	0.591	0.580	-0.011
Total	4.265	4.116	5.750	1.634	4.333	4.333	4.157	-0.176	1.381	1.000	0.927	-0.073

Table 12.6: Abstract of Basin States Share Account and Utilization of Sutlej Water as per BBMB (in Maf)

Year & period	Sharable Supplies	Share of Partner States					Deliveries / Utilization					Excess / Shortage to Rajasthan		Supplies in RF-SF Link
		Punjab	Haryana	Rajasthan			Punjab	Haryana	Rajasthan					
				Via Punjab	Via Haryana	Total			Via Punjab	Via Haryana	Total	Via Punjab	Via Haryana	
1	2	3	4	5(a)	5(b)	5(c)	6	7	8(a)	8(b)	8(c)	9(a)	9(b)	10
2002-03														
Filling	4.655	2.601	1.576	0.301	0.177	0.478	3.294	1.710	0.068	0.120	0.188	-0.233	-0.057	0.208
Depletion	5.471	2.943	1.968	0.359	0.203	0.562	2.979	2.331	0.384	0.156	0.540	0.025	-0.047	0.158
Total	10.126	5.544	3.544	0.660	0.380	1.040	6.273	4.041	0.452	0.276	0.728	-0.208	-0.104	0.366
2003-04														
Filling	4.560	2.557	1.528	0.299	0.176	0.475	3.189	1.607	0.280	0.133	0.413	-0.019	-0.043	0.077
Depletion	6.490	3.369	2.415	0.444	0.262	0.706	3.840	2.729	0.455	0.217	0.672	0.011	-0.045	0.124
Total	11.050	5.926	3.943	0.743	0.438	1.181	7.029	4.336	0.735	0.350	1.085	-0.008	-0.088	0.201
2004-05														
Filling	3.523	2.040	1.133	0.220	0.130	0.350	2.195	1.217	0.192	0.074	0.266	-0.028	-0.056	0.039
Depletion	3.431	1.884	1.211	0.207	0.129	0.336	1.612	1.512	0.375	0.115	0.490	0.168	-0.014	0.082
Total	6.954	3.924	2.344	0.427	0.259	0.686	3.807	2.729	0.567	0.189	0.756	0.140	-0.070	0.121
2005-06														
Filling	3.901	2.152	1.334	0.261	0.154	0.415	2.670	1.498	0.278	0.104	0.382	0.017	-0.050	0.072
Depletion	5.655	2.826	2.214	0.376	0.239	0.615	3.348	2.640	0.490	0.206	0.696	0.114	-0.033	0.089
Total	9.556	4.978	3.548	0.637	0.393	1.030	6.018	4.138	0.768	0.310	1.078	0.131	-0.083	0.161
2006-07														
Filling	5.543	3.300	1.795	0.282	0.166	0.448	3.548	1.864	0.300	0.119	0.419	0.018	-0.047	0.047
Depletion	5.917	3.218	2.090	0.383	0.226	0.609	2.776	2.585	0.610	0.233	0.843	0.227	0.007	0.083
Total	11.460	6.518	3.885	0.665	0.392	1.057	6.324	4.449	0.910	0.352	1.262	0.245	-0.040	0.130
2007-08														
Filling	4.637	2.697	1.479	0.290	0.171	0.461	2.825	1.534	0.311	0.124	0.435	0.021	-0.047	0.048
Depletion	5.385	2.930	1.903	0.347	0.205	0.552	2.800	2.253	0.442	0.187	0.629	0.095	-0.018	0.008
Total	10.022	5.627	3.382	0.637	0.376	1.013	5.625	3.787	0.753	0.311	1.064	0.116	-0.065	0.056
2008-09														

Year & period	Sharable Supplies	Share of Partner States					Deliveries / Utilization					Excess / Shortage to Rajasthan		Supplies in RF-SF Link
		Punjab	Haryana	Rajasthan			Punjab	Haryana	Rajasthan					
				Via Punjab	Via Haryana	Total			Via Punjab	Via Haryana	Total	Via Punjab	Via Haryana	
1	2	3	4	5(a)	5(b)	5(c)	6	7	8(a)	8(b)	8(c)	9(a)	9(b)	10
Filling	4.163	2.309	1.413	0.277	0.164	0.441	2.730	1.553	0.285	0.148	0.433	0.008	-0.016	0.018
Depletion	5.348	2.693	2.051	0.380	0.224	0.604	3.051	2.371	0.564	0.282	0.846	0.184	0.058	0.089
Total	9.511	5.002	3.464	0.657	0.388	1.045	5.781	3.924	0.849	0.430	1.279	0.192	0.042	0.107
2009-10														
Filling	4.835	2.754	1.594	0.306	0.180	0.486	2.987	1.686	0.307	0.126	0.433	0.001	-0.054	0.018
Depletion	5.182	2.906	1.764	0.322	0.190	0.512	2.720	2.046	0.356	0.153	0.509	0.034	-0.037	0.032
Total	10.017	5.660	3.358	0.628	0.370	0.998	5.707	3.732	0.663	0.279	0.942	0.035	-0.091	0.050

12.2.7 Ghaggar River Basin

Ghaggar River pertains to the Indus river system. It originates from the Shiwalik hills in Himachal Pradesh and enters Haryana in Ambala, flows through part of Punjab before it re-enters Ambala whence it continues further in the Haryana State till its exit at Sirsa to enter Rajasthan. The Markanda, the Tangri (also known as Dangri), the Saraswati and the Chautang are its important tributaries. The river has a total catchment of 34,076 km^2 and is spread over the States of Himachal Pradesh (560 km^2), UT of Chandigarh (114 km^2), Haryana (13,400 km^2), Punjab (14,800 km^2) and Rajasthan (5,202 km^2).

For most parts, Ghaggar basin consists of flat plains, with gentle gradient towards the west except for a small area at the extreme eastern edge near the origin, which is hilly. The total length of the river is about 560 kms from the origin. Ghaggar basin has three distinct geological and geomorphological units namely, Shiwalik hills ranging from 400 m to 1,000 m amsl, Kandi belt at altitudes of 300 m to 400 m amsl running parallel to Shiwalik range, and the alluvial plains ranging from the altitude of 300 m amsl in the east to 150 m amsl in the extreme west.

The river runoff dependability as assessed in TAHAL – WAPCOS report on the water resources of Haryana State, 2000 are shown Table 12.7.

Table 12.7: Availability of Water from River Ghaggar

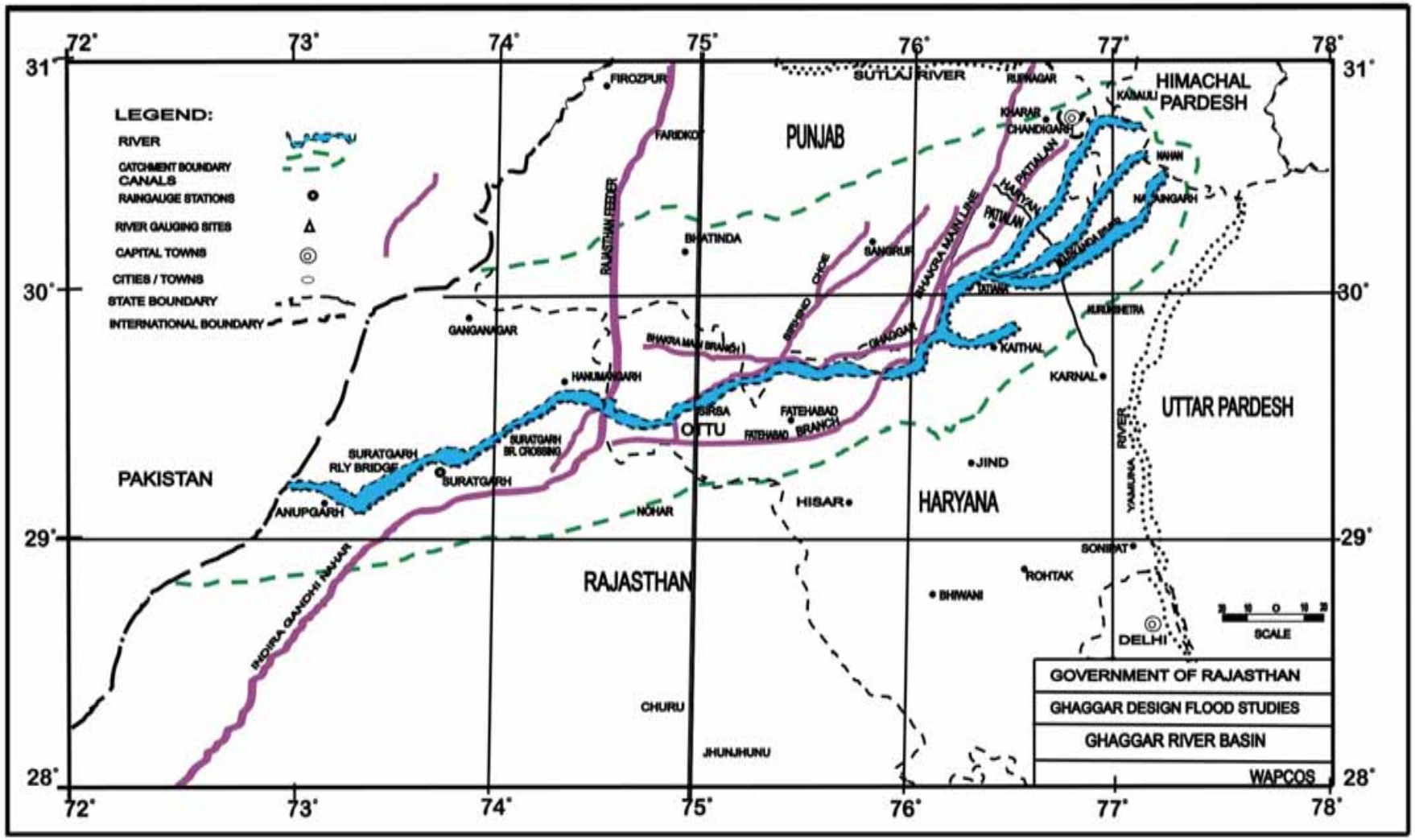
Dependability	Availability, Mm^3
Mean	629.03
25%	846.18
50%	478.60
75%	238.71
90%	93.75

Source: Haryana State Water Resources, Tahal – WAPCOS, 2000

The Ghaggar River, being well defined in Punjab and Haryana, forms a basin known as Ghaggar basin. In Rajasthan however, from its entry point to its tail at the Pakistan border near Anupgarh, it is like a drain called “the Nali bed”, which subsequently disappears in the Thar Desert.

The Ghaggar Basin partly overlaps the command area of IGNP and Bhakhra Canal. Supplies to some of Bhakhra and IGNP canals come from Ghaggar whenever there is surplus water in it, as shown in Figure 12.1.

Figure 12.1: Ghaggar River Basin in Rajasthan State



In the past, Ghaggar Nali bed was rarely subjected to any damage due to floods of appreciable magnitudes. However, during the last few decades the hydrological conditions in Ghaggar catchment area have changed and the floods in the river are increasing and posing serious threat to the Ghaggar Nali bed.

Notable structures that relate to flood control measures are:

Ottu Weir, near Ottu village. Constructed in the year 1896-97, the weir diverts water into three irrigation canals.

Salient features of this structure are as follows:

- Weir
  Pond level: 197.6 m
  Crest level: 194.9 m
  Total length: 121.9 m

The weir is provided with wooden needle shutters.

- Canals
  Northern Ghaggar Canal: 244.00 m^3/sec
  Sothern Ghaggar Canal : 487.40 m^3/sec
  Sheranwali Parallel Channel: 547.00 m^3/sec

Three canals have been constructed in the Ottu area to utilize the flood flows of Ghaggar River. These are, the North Ghaggar and South Ghaggar canals and the Sheranwali feeder canal.

Since the opening of Bhakhra canal system, the seasonal North Ghaggar and South Ghaggar canals are fed by the Bhakhra system during the dry period, thereby supplementing the base flow from Ghaggar River.

Almost all the existing irrigation canal systems in Ghaggar River Basin are sustained by the water supplied from the adjoining IGNP and Bhakra canals. Ghaggar water is supplied only in part during the monsoon months, when available.

Because of the nature of the topography, Ghaggar River and its tributaries spill over a large area on both the banks. To contain the flows of the river and its tributaries in the upper reaches (in Punjab and Haryana), embankments, or bunds, have been constructed along Markanda River, Tangri Nadi and Ghaggar River. The effects of these bunds and embankments have caused flooding in Rajasthan which was otherwise free from the flooding threats.

Downstream of Ottu weir, Ghaggar River has been canalised through its entire course in Haryana and upto Indira Gandhi Nahar Feeder crossing.

Ghaggar Diversion Canal (GDC)

In order to minimize the increasing flood hazards, the Ghaggar Flood Control Project was sanctioned in 1965. The project envisaged construction of Ghaggar Diversion Channel (GDC), starting from Indira Gandhi Nahar Feeder at RD 0 to RD 158.7 at its end. The flood water diverted into the GDC was to fill 19 depressions located in the sand-dunes between Indira Gandhi Nahar and its Suratgarh branch. The work was completed in 1966. The Ghaggar Flood Control Project area is shown Figure 12.2.

Flood Characteristics

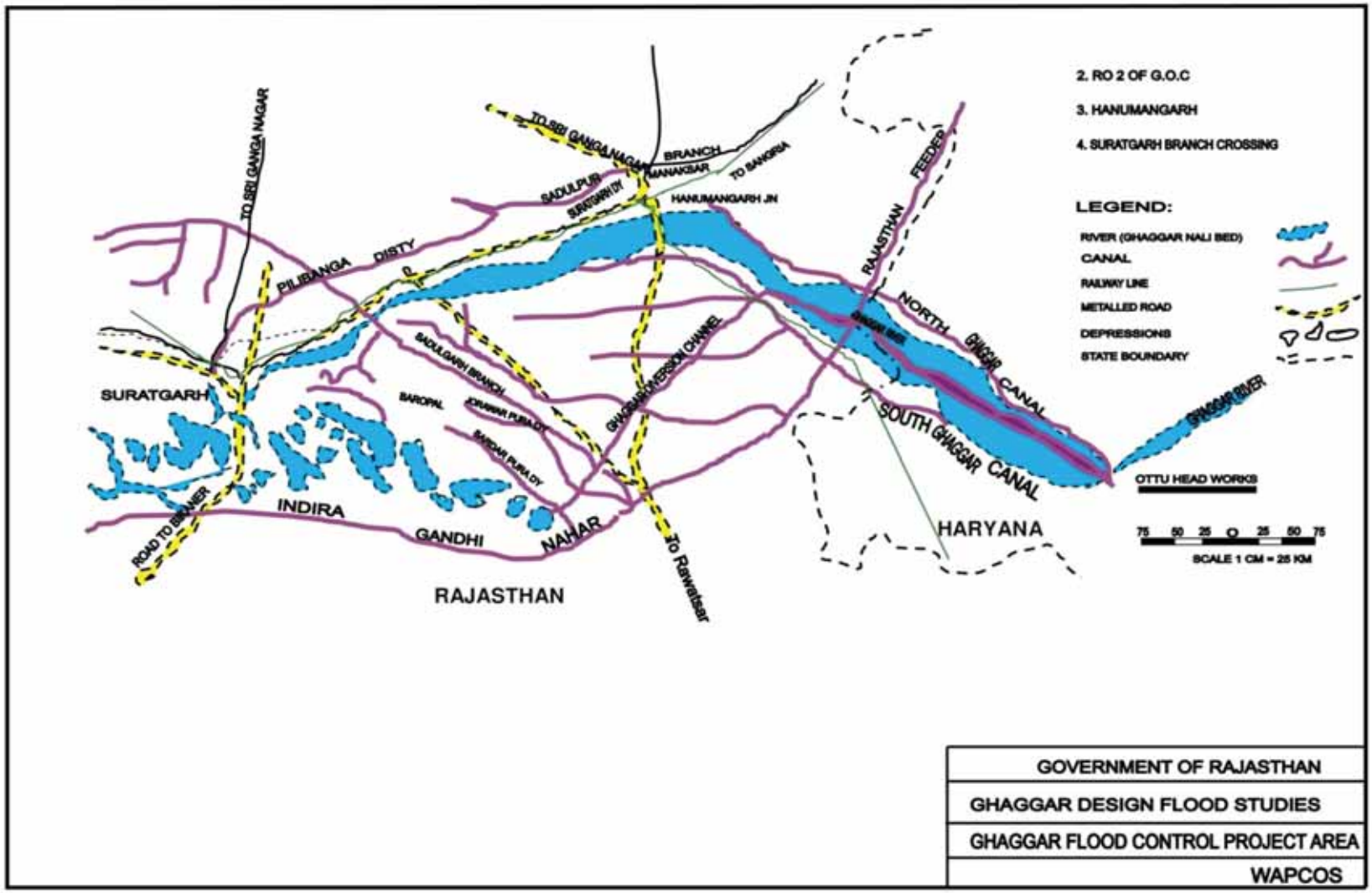
The Ghaggar River has been extinct for many centuries but has again revived and is causing more and more floods. The process began with occasional short duration floods of lower intensities in 1950 and since then the frequency and duration of floods have been on the increase.

Prior to 1955, the flood waters of the Ghaggar travelled only once beyond Pilibanga. After 1955, the intensity of floods as well as volume and duration started to cause damages to crops and properties. In 1958 flood season, the flood water travelled 60 kms beyond Hanumangarh. In 1962, the flood water nearly touched the Pakistan border which is about 308 kms from Hanumangarh along the Nali bed and in 1964 it crossed into Pakistan.

The revival of floods in Ghaggar Nali bed has been attributed to the following causes:

- Punjab and Haryana have constructed flood protection embankments in their territories along the Ghaggar River and its tributaries.
- Extensive irrigation in Punjab and Haryana from Bhakra Canal system has raised the groundwater table, which is likely to rise further. This has reduced the flood absorption capacity of the Ghaggar catchment.
- In order to control the water logging problem, Punjab and Haryana Governments have undertaken construction of new drains and channelling of the several ‘choes’ and existing drains on a large-scale. These drains and choes bring, to some extent, additional flows in the Ghaggar River.

Figure 12.2: Ghaggar River Basin Flood Control Works



Floods in the Ghaggar River relate to heavy rainfall spells, which occur during the monsoon season. Severe rainstorms, particularly in the upper catchment, are caused occasionally by the moving low-pressure areas/depressions which occur towards the end of monsoon or early October. Extremely severe rainstorms in this region are known to have been experienced under the combined influence of depressions from the Bay of Bengal and the western disturbances, though such combination occurs rarely.

Floods in the upper hilly catchment are characterised by high peak values at comparatively shorter durations. In the middle and lower reaches, the floods have moderately high flood over a sustained period of two to three weeks. Because of decrease in rainfall magnitudes, sandy tracts and large valley storage due to the topography of the area, the floods in the Ghaggar undergo considerable attenuation during their passage downstream.

Statement showing maximum water levels and maximum water stored in Ghaggar depressions for the period 1972 to 2010 is given in Table 12.8.

Table 12.8: Maximum Water Levels in Ghaggar Depressions from Year 1972 to 2010

S. No.	Year	Date	Maximum Level (ft amsl)	Water in Depression	Maximum Water in Depression	
					in Maf	in Mm^3
1	1972	03.09.72	594.68 Dep-II	Depression no. I to XV	0.060	74.01
2	1973	28.08.73	585.60 Dep-II	Depression no. I to XI	0.036	44.41
3	1974	29.07.74	586.45 Dep-II	Depression no. I to XI	0.043	53.04
4	1975	20.09.75	598.45 Dep-II	Depression no. I to XVI	0.120	148.02
5	1976	03.09.76	600.90 Dep-II	Depression no. I to XVIII	0.170	209.69
6	1977	07.02.77	595.85 Dep-II	Depression no. I to XV	0.024	29.60
7	1978	21.09.78	599.85 Dep-II	Depression no. I to XVI	0.310	382.38
8	1979	06.03.79	596.15 Dep-II	Depression no. I to XVI	0.020	24.67
9	1980	19.08.80	593.65 Dep-II	Depression no. I to XV	0.078	96.21
10	1981	20.08.81	589.80 Dep-II	Depression no. I to XI	0.053	65.37
11	1982	19.08.82	595.85 Dep-II	Depression no. I to XVI	0.160	197.36
12	1983	06.09.83	600.80 Dep-II	Depression no. I to XVIII	0.480	592.07
13	1984	21.01.84	594.30 Dep-II	Depression no. I to XVI	0.044	54.27
14	1985	01.01.85	586.85 Dep-XI	Depression no. I to XI	0.038	46.87
15	1986	17.08.86	582.30 Dep-VI	Depression no. I to VI	0.001	1.23
16	1987					
17	1988	10.10.88	600.80 Dep-VI	Depression no. I to XVIII	0.430	530.40
18	1989	23.09.89	590.85 Dep-VI	Depression no. I to VI	0.020	24.67
19	1990	29.09.90	590.25 Dep-VI	Depression no. I to VI	0.040	49.34
20	1991	01.06.91	585.55 Dep-XI	Depression no. I to VI	0.003	3.70
21	1992	15.08.92	584.85 Dep-VI	Depression no. I to VI	0.001	1.23
22	1993	25.07.93	588.95 Dep-XI	Depression no. I to XI	0.080	98.68
23	1994	12.08.94	585.90 Dep-VI	Depression no. I to VI	0.070	86.34
24	1995	22.09.95	600.40 Dep-VI	Depression no. I to XVIII	0.180	222.03

S. No.	Year	Date	Maximum Level (ft amsl)	Water in Depression	Maximum Water in Depression	
					in Maf	in Mm^3
25	1996	01.01.96	591.75 Dep-VI	Depression no. I to VI	0.130	160.35
26	1997	29.01.97	589.00 Dep-VI	Depression no. I to XV	0.058	71.54
27	1998	31.10.98	590.75 Dep-VI	Depression no. I to XV	0.110	135.68
28	1999	11.02.99	584.60 Dep-VI	Depression no. I to XV	0.030	37.00
29	2000	31.07.00	586.90 Dep-VI	Depression no. I to VIII	0.038	46.87
30	2001	27.08.01	584.20 Dep-VI	Depression no. I to VI	0.020	24.67
31	2002					0.00
32	2003	NA	NA	Depression no. I to VI	0.001	1.23
33	2004	04.09.04	578.10 Dep-VI	Depression no. I to VI	0.010	12.33
34	2005					
35	2006					
36	2007	09.07.07	580.00 Dep-VI	Depression no. I to VI	0.003	3.70
37	2008	05.10.08	581.60 Dep-VI	Depression no. I to VI	0.010	12.33
38	2009	2009	576.40 Dep-VI	Depression no. I to VI	-	-
39	2010	01.01.10	590.40 Dep-VI	Depression no. I to XII	0.080	98.68

Source: WRD, Rajasthan

While planning the depressions, it was envisaged that part of the stored water would percolate down to groundwater, while part would evaporate. However, the infiltration rate turned out to be not as high as anticipated; therefore, the depressions could not be emptied in time to accommodate the following season's floods.

This permanent impoundment of water in the depressions was aggravating the problem of water logging. To utilise the impounded water, Rajasthan government planned to take water from the depressions for irrigation. At present there are two such irrigation canals, drawing water from depression VI (at 0.68 m^3/sec via the Manak Their minor) and from depression XI (at 0.4 m^3/sec via the Kishanpura minor). Since the discharge of these two minors is quite low compared to the quantity of water stored, Rajasthan government is considering additional proposals for utilising the water of the depression-reservoir system.

Annual and Monsoon Rainfalls

Anupgarh and Suratgarh rain gauge stations lie in arid zone whereas Hanumangarh and Nohar lie in semi-arid zone. The mean monsoon and annual rainfalls of these four stations are given in Table 12.9. Viewing this table, it is observed that about 78% of annual rainfall is received in monsoon season.

The normal monthly rainfalls of these four stations representing Arid and Semi Arid zones are shown in Table 12.10.

Table 12.9: Annual and Monsoon (June through September)

Rainfall in Ghaggar Basin (1980-2010) Station	Mean Monsoon Rainfall, mm	Mean Annual Rainfall, mm	% of Annual Rainfall during Monsoon
Arid Zone			
Anupgarh	164.27	209.03	
Suratgarh	169.83	219.88	
Average	167.05	214.46	78.0%
Semi-arid Zone			
Hanumangarh	162.09	210.75	
Nohar	229.77	288.71	
Average	195.93	249.73	78.5%

Table 12.10: Monthly Average Normal Rainfall (1980-2010) June through October, mm

Station	Jun	Jul	Aug	Sept	Oct	Total
Arid Zone						
Anupgarh	25.31	70.40	49.02	19.55	6.32	170.60
Suratgarh	22.84	72.64	53.72	20.63	5.10	174.93
Semi-arid Zone						
Hanumangarh	35.37	61.53	34.84	30.35	1.45	163.54
Nohar	30.35	96.00	67.84	35.58	4.74	234.51

Runoff Measurements

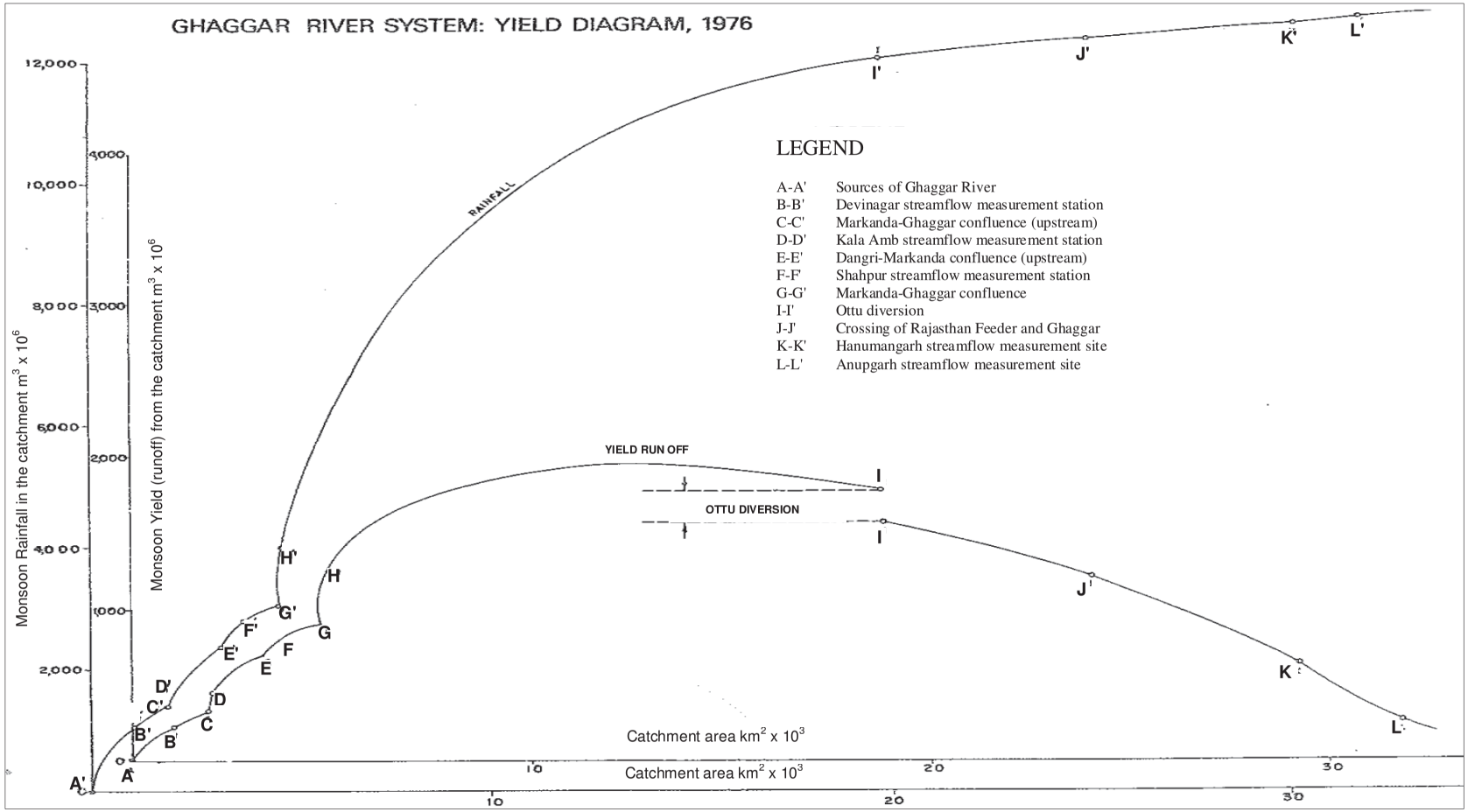
Runoff measurements of the Ghaggar River and its tributaries were conducted during 1976 and 1977 at the following sites (Source: UNDP Report 1985):

- Ghaggar River
  Panchkula (1976 and 1977)
  Devinagar (1976 and 1977)
  Tatiana (1976 and 1977)
  Khaireka (1976) and Ottu (1977)
  Hanumangarh (1976 and 1977)
  Anupgarh (1976 and 1977)
- Dhangri River : Shahpur (1976 and 1977)
- Markanda River: Kala Amb (1976 and 1977)
- Saraswati River: Pipli (1976 and 1977)
- Amri Choe :
  Shahjadpur (1977 only)
  Mithapur (1977 only)
- Patiala Wali Rao: Chandigarh (1977 only)

Yield Diagram and Assessment

In order to determine the runoff from the catchment above any point in the river system, a diagram is to be prepared giving the relation of the area of the catchment to the yield (i.e. amount of runoff generated). The amount of rainfall for the corresponding area is then super-imposed on the same diagram to produce a yield diagram. The yield diagram for the year 1976 monsoon season prepared for Ghaggar River as given in Figure 12.3.

Figure 12.3: Year 1976 Monsoon Yield Diagram for Ghaggar River System in Rajasthan (Source: UNDP Report 1985)


GHAGGAR RIVER SYSTEM: YIELD DIAGRAM, 1976
LEGEND
A-A' Sources of Ghaggar River
B-B' Devinagar streamflow measurement station
C-C' Markanda-Ghaggar confluence (upstream)
D-D' Kala Amb streamflow measurement station
E-E' Dangri-Markanda confluence (upstream)
F-F' Shahpur streamflow measurement station
G-G' Markanda-Ghaggar confluence
I-I' Ottu diversion
J-J' Crossing of Rajasthan Feeder and Ghaggar
K-K' Hanumangarh streamflow measurement site
L-L' Anupgarh streamflow measurement site
RAINFALL
YIELD RUN OFF
OTTU DIVERSION
Monsoon Rainfall in the catchment m3 x 10^6
Monsoon Yield (runoff) from the catchment m3 x 10^6
Catchment area km2 x 10^3
Catchment area km2 x 10^3

From the yield diagram, it appears that the yield from Ghaggar River basin steadily increased as far as Jukal, beyond which, it stabilises. It is at its highest level at Sadulgarh; beyond which the yield decreased rapidly.

As explained above, the Ghaggar River course in Rajasthan generally used to remain dry due to less inflows and sandy soils. But after development of irrigation systems in Punjab, Haryana and Rajasthan and also due to formation of embankments on both sides of Ghaggar River in upper states, large quantities of water arrive in Ghaggar Nali in Rajasthan, which caused floods many times.

In the previous 20 years the climatic behaviour all over the country has changed due to increase in irrigated area, deforestation, industrialization, rapid urbanization, global warming, etc.; Ghaggar River basin has also been affected by the climatic changes.

The current data of previous 31 years (1980 to 2010) has been used to be close to the present scenario. Rainfall data are available for the last 100 years and data on water released to Rajasthan from relevant weir are available since 1950, but in the analysis both data have been taken from 1980 to 2010.

As evident from Tables 12.9 and 12.10, the rainfall in Ghaggar river catchment in Rajasthan area is very small. This little rainfall contributes a very small yield in the catchment and the main source of inflows is the water release from upstream barrages. Thus, the total in Rajasthan's portion of Ghaggar River may be derived by adding:

- Water released from upstream, notably the Ottu Barrage, and
- Yield generated due to rainfall in Rajasthan's portion of Ghaggar River catchment.

Inflows from Ottu Barrage

The monsoon and non-monsoon water releases from Ottu barrage on Ghaggar River arriving in Rajasthan are available since 1950 to 26th August 2011 as compiled in Table 12.11. However as explained above, for realistic analysis water releases from 1980 to 2010 have been considered.

Table 12.11: Monsoon and Non-Monsoon Runoff in Ghaggar River Downstream of Ottu Weir (in Mm^3)

Year	Monsoon Runoff	Non-Monsoon Runoff	Total Runoff
1950	209.70	0.00	209.70
1951	24.67	24.67	49.34
1952	111.02	0.00	111.02
1953	148.02	0.00	148.02
1954	69.08	0.00	69.08
1955	271.37	168.99	440.36
1956	300.97	131.98	432.95

Year	Monsoon Runoff	Non-Monsoon Runoff	Total Runoff
1957	231.90	9.87	241.77
1958	344.15	205.99	550.14
1959	753.67	61.68	815.35
1960	653.76	12.34	666.10
1961	719.13	98.68	817.81
1962	661.16	203.53	864.69
1963	494.63	0.00	494.63
1964	2,074.75	61.68	2,136.43
1965	260.27	0.00	260.27
1966	609.35	0.00	609.35
1967	259.04	0.00	259.04
1968	801.78	0.00	801.78
1969	613.05	0.00	613.05
1970	503.27	0.00	503.27
1971	1,139.75	2.47	1,142.22
1972	336.75	1.23	337.98
1973	970.76	0.00	970.76
1974	98.68	0.00	98.68
1975	888.12	0.00	888.12
1976	1,004.07	0.00	1,004.07
1977	826.45	1.23	827.68
1978	1,578.88	0.00	1,578.88
1979	243.00	86.35	329.35
1980	478.60	0.00	478.60
1981	262.74	0.00	262.74
1982	374.98	66.61	441.59
1983	1,042.31	177.62	1,219.93
1984	89.88	9.87	99.75
1985	0.00	0.00	0.00
1986	0.00	0.00	0.00
1987	0.00	0.00	0.00
1988	2,454.67	397.19	2,851.86
1989	378.81	0.00	378.81
1990	763.70	0.00	763.70
1991	8.89	0.00	8.89
1992	191.40	0.00	191.40
1993	908.22	0.00	908.22
1994	1,110.92	0.00	1,110.92
1995	1,797.94	0.00	1,797.94
1996	470.81	0.00	470.81
1997	235.66	0.00	235.66
1998	368.87	238.28	670.15

Year	Monsoon Runoff	Non-Monsoon Runoff	Total Runoff
1999	177.60	0.00	177.60
2000	399.64	0.00	399.64
2001	320.70	0.00	320.70
2002	65.37	0.00	65.37
2003	159.11	0.00	159.11
2004	303.13	0.00	303.13
2005	87.40	0.00	87.40
2006	20.92	0.00	20.92
2007	52.91	0.00	52.91
2008	405.15	0.00	405.15
2009	133.22	0.00	133.22
2010	1,208.18	0.00	1,208.18
Oct-26-2011(2011)	409.44	0.00	409.44
Average (1980-2010)			**489.07**

Source: WRD, Rajasthan

The average yearly tail water of Ghaggar River available to Rajasthan from other States works out to be 489.07 Mm^3, which can also be considered as imported water. Availability of this Ghaggar flood water at different dependabilities is as follows (as per distribution pattern from Table 12.7):

Dependability Level	25%	50%	75%	90%	Mean
Ghaggar flood water, Mm^3/yr	657.90	372.11	185.60	72.89	489.07

12.2.8 Ganga River Water

The National Water Development Agency (NWDA) has conducted a study for transferring water of Sharda River, a tributary of Ganga River, to Rajasthan. The study envisages transfer of 2,736 Mm^3 of water out of 17,906 Mm^3 (15.28%) of surplus water available in Sharda River. The study proposes irrigation benefits by flow of CCA of 4.02 Lakh ha in Churu, Ganganagar, Hanumangarh, Bikaner Jodhpur and Jaisalmer districts.

While forwarding the comments of the State to the NWDA, Rajasthan has suggested that about 45,800 Mm^3 of water would be required to provide irrigation to CCA of about 41.5 lakh ha (about 11,000 m^3/ha) in the arid regions of the State, alongside IGNP by flow and lift of 60 m to 90 m. By the time of preparation of this report (January 2013) response from NWDA in the matter was still pending.

12.3 Yamuna River Water Import System (Gurgaon & Bharatpur Canal)

Yamuna River originates from Yamunotri Glacier in the Himalayas. The river traverses through the States of Himachal Pradesh, Uttar Pradesh, Uttaranchal, Haryana and Delhi, till it confluences with Ganga River, and is joined by various tributaries on the way. The catchment area of the river up to Okhla is 42,913 km^2.

Historically, Yamuna River is gauged at two sites within the reach of interest (Origin to Okhla): in the upper reach at Tajewala Headworks, and in the lower reach at Okhla Weir site near Delhi. For determining the shares of Yamuna water between the various riparian states, the virgin inflow series at Okhla for the period 1951-74 has been considered.

The stream flows at Okhla have to be adjusted considering utilisation by UP upstream of and at Tajewala, utilisation by Haryana at Tajewala, utilisation by Delhi at Wazirabad and C-power station, Hindon outflows, and withdrawal through Agra canal. The river flow data at Okhla Weir site include spills across Tajewala Headworks and the combined annual flow series, which is the virgin flow series at Okhla, is given in Section 12.8 below. The water prorata shares computed on the basis of Okhla inflows at various dependabilities are given in Table 12.12.

Table 12.12: Yamuna River Flow at Selected Dependability Levels

Dependability	Okhla Inflows		Rajasthan's Prorata Share	
	Bm^3/yr	Percent	Bm^3/yr	Mm^3/yr
Mean	13.84	100.00%	1.119	1,119
25%	16.54	119.51%	1.337	1,337
50%	13.33	96.32%	1.078	1,078
75%	11.33	81.86%	0.916	916
90%	8.30	59.97%	0.671	671

Haryana and Uttar Pradesh have been utilising water from Yamuna River at Tajewala and Okhla for irrigating large tracts under the Western Yamuna Canal, Eastern Yamuna Canal as well as Agra and Gurgaon Canal systems. Delhi is utilising the Yamuna water from Tajewala and Wazirabad and also along the course of the river from Wazirabad to Okhla to meet domestic and industrial demands. Rajasthan is also utilising some water from Okhla, while Himachal Pradesh is using limited quantities of water upstream of Tajewala. Interstate disputes on sharing the water of this river up to Okhla were pending since long time. The Government of India continued discussions with the basin States for a number of years, and eventually it was resolved on 12 May 1994 by reaching an MoU agreed by the five basin States.

The 75% dependability value of the virgin flow in Yamuna River at Okhla is assessed at about 11,700 Mm^3 and the mean yearly flow at about 13,000 Mm^3. The value taken for the water allocation to the basin States is 11,983 Mm^3, with

Rajasthan's share being 1,119 Mm^3 (0.91 Maf), or 9.34% of the total. Table 12.13 presents the interim allocation to the basin states, pending construction of considered storage dams in the upper reaches of the river.

Table 12.13: Seasonal Interim Water Allocation between Yamuna River Basin States, Mm^3

State	Seasonal Water Allocation							
	Jul. - Oct.		Nov. - Feb.		Mar. - Jun		Annual	
	Mm^3	Percent	Mm^3	Percent	Mm^3	Percent	Mm^3	Percent
Haryana	4,107	34.3%	686	5.7%	937	7.8%	5,730	47.8%
Uttar Pradesh	3,216	26.8%	343	2.9%	473	3.9%	4,032	33.6%
Rajasthan	963	8.0%	70	0.6%	86	0.7%	1,119	9.3%
Himachal Pradesh	190	1.6%	108	0.9%	80	0.7%	378	3.2%
Delhi	580	4.8%	68	0.6%	76	0.6%	724	6.0%
Total	**9,056**	**75.6%**	**1,275**	**10.6%**	**1,652**	**13.8%**	**11,983**	**100.0%**

Apart from allocation within the States, it is stipulated that a minimum of 10 m^3/sec of water will be maintained as minimum flow in Yamuna river D/S of Tajewala and Okhla, accounting for 325 Mm^3 annually. It is also estimated that 680 Mm^3 of floodwater may not be utilisable as a result of unavoidable spills. These together with the shares (11,983 + 325 + 680) account for a mean year availability of about 13,000 Mm^3.

Clause 4 of the MoU provides that "to maximise the utilization of the surface flow of Yamuna River, a number of storage projects have been identified". Clause 7 states that "the said interim seasonal allocation shall progressively modified as storage is constructed. Three storage dams, namely: Kishau, Renuka and Lakhwar-Vyasi have been identified. Separate agreement will be executed in respect of each identified storage, within the framework of the overall allocation made in this agreement". Salient Features of these dams are given in Table 12.14.

Table 12.14: Salient Features of Considered Storage Dams

S. No.	Name of Project	River	State	Live Storage, Mm^3	Power, MW	Estimated Cost, Crore Rs.	Executing Agency	Share of Rajasthan as per MoU (9.34%), MW
1	Renuka	Giri	Himachal Pradesh	456	40	3,896.83	[1]	3.74
2	Kishau	Tons	Uttrakhand	1,324	600	3,566.23	[2]	56.00
3	Lakhwar-Vyasi	Yamuna	Uttrakhand	331	420	4,231.28	[3]	39.23
	Total			**2,111**	**1,060**	**11,694.34**		**98.97**

Note: Price levels for cost estimates:Renuka: Dec. 2006; Kishau: Dec. 1998; Lakhwar-Vyasi: Mar. 2006
[1] Himachal Pradesh State Electricity Board (HPSEB)
[2] Tehri Hydro Corporation Ltd. (THDC)
[3] National Hydel Power Corporation (NHPC)

Faced with the dams' features and raised complaints from the basin States, an Upper Yamuna River Board (UYRB) was established, which decided on modified tentative seasonal water distribution to Rajasthan, as given in Table 12.15.

Table 12.15: Modified Tentative Seasonal Distribution of Yamuna River Water to Rajasthan

Period	Seasonal Allocation				
	Mm^3	Maf	Cusec		
			At Tajewala	At Okhla	Total
Jul. - Oct.	963	0.78	1,917	1,281	3,198
Nov. - Feb.	70	0.06		238	238
Mar. - Jun	86	0.07		288	288
Total	**1,119**	**0.91**	**1,917**	**1,807**	**3,724**

Due to the restricted capacity of its existing canals, Rajasthan could not cope with that decision and proposed to utilize its share of Yamuna water partly in Churu District (in the Outside basin) and partly in Bharatpur District (Banganga basin) as given in Table 12.16.

Table 12.16 Rajasthan's Proposed Option for Monsoon Period Yamuna Water Abstraction

Sr.No.	Proposal	CCA, lakh ha	Off-take	Flow, cusec	Estimated Cost Crore Rs
1	Utilization in Bharatpur District	1.20	Gurgaon Canal	981	175
			Bharatpur feeder	300	
2	Utilization in Jhunjhunu-Churu District	1.96	At Tajewala	2,500	935
	Total	**3.16**		**3,781**	**1,110**

Water in the Bharatpur District is conveyed through Gurgaon Canal in Haryana that takes off from Okhla Barrage near Delhi. A second point from where water to Bharatpur is diverted is from Agra Canal, near Mathura in UP. Agra Canal also off-takes from Okhla Barrage.

There is another barrage, Tajewala, in Haryana State, so that at present Haryana utilizes most of Yamuna flows at Tajewala headworks and very little water is available at Okhla headworks for Agra Canal.

Regarding supplies to Churu District, Rajasthan has proposed to take its water from Western Yamuna canal of Haryana, taking off from Tajewala headwork.

A final agreement about these proposals is under negotiations between the two States and no work on this canal system has been initiated.

Statement of actual utilization of water from Yamuna River for the period from January 2005 to 2011 (inclusive) is given in Section 12.8 below.

12.4 Chambal River System

Chambal River Basin in Rajasthan is an in-between section of the entire river's watershed. The river originates in Madhya Pradesh State, enters Rajasthan where it has a sizable additional watershed giving rise to several tributaries, and then leaves Rajasthan and enters Uttar Pradesh State. The account in this report relates to the portion of the River Basin that lies within Rajasthan.

12.4.1 General Setup

Chambal River takes off in Vindhyan range near Mhow town in Indore District of Madhya Pradesh at an elevation of 354 m amsl. The basin is roughly rectangular in shape with a maximum length of about 560 kms in south-west to north-east direction. The river flows for some 320 kms in a generally north direction before entering a deep gorge in Rajasthan at Chaurasigarh, about 96 km upstream of Kota Barrage. The deep gorge extends up to Kota, and the river then flows for about 226 kms inside Rajasthan in a north-east direction. Thereafter, the river forms a boundary between MP and Rajasthan for about 252 kms, and then forms the boundary between MP and UP for about 117 kms. Eventually, it joins Yamuna River after traversing some 40 kms in UP. The state-wise breakdown of Chambal River watershed (catchment area) is given in Table 12.17.

Table 12.17: State-wise Share of Chambal River Watershed

State	Watershed Area	
	km²	Percent
Madhya Pradesh	56,976	41.52%
Rajasthan	79,401	57.86%
Uttar Pradesh	842	0.61%
Total	**137,219**	**100.00%**

The water availability in the Chambal Basin is assessed at 24,094 Mm^3/yr, with dependability levels as given in Table 12.18.

Table 12.18: Dependability Levels of Chambal River Yield

Dependability Level	25%	50%	75%	90%	Mean
River Yield, Mm^3/yr	30,813	20,987	14,035	9,614	24,094

Utilization of Chambal River water has been conceived as a multi-purpose scheme, comprising three dam systems as follows (from upstream downward):

- **Gandhi Sagar (GS Dam)** with capacity of 7,143 Mm^3, located in Madhya Pradesh. The 75% dependable yield at this dam has been assessed at 3.80 Maf (4.687 Mm^3) but the capacity of this dam has been set at 6.2 Maf (7,648 Mm^3) to store water whenever it is available. There is provision for power generation of 5x23 MW, with proposed addition of 4x40 MW.

- **Rana Pratap Sagar (RPS Dam)** with storage capacity of 2,899 Mm^3 it has provision of power generation of 4x43 MW, and **Jawahar Sagar (JS Dam)** with storage capacity of 68 Mm^3 and provision of power generation of 3x33 MW, located in Rajasthan. These are balancing reservoirs for power production.

- **Kota Barrage, Downstream of JS Dam**, from where two canals off takes named Right Main Canal (RMC) with head discharge of 188 m^3/s (6,656 cusec), and Left Main Canal (LMC) with head discharge of 42 m^3/s (1,500 cusec) to provide irrigation of 2.29 Lakh ha CCA in Rajasthan and 2.29 lakh ha CCA in Madhya Pradesh.

The Chambal Valley Project conceived for utilization of water available in Chambal River upto Kota Barrage has been executed jointly by Madhya Pradesh and Rajasthan. The waters of Chambal River and Hydel Power generation thereto are to be shared between Madhya Pradesh and Rajasthan in equal proportion. The total water available upto Kota Barrage has been assessed as 3.2 Maf (3,946 Mm^3) at 75% dependability. Accordingly the share of Rajasthan becomes 1,973 Mm^3/yr at 75% dependability, values for other dependabilities are shown below.

Dependability Level	25%	50%	75%	90%	Mean
Rajasthan's Share in Chambal waters at Kota Barrage, Mm^3/yr	4,332	2,950	1,973	1,352	3,387

The water utilization by both States in the system for 16 years is given in Table 12.19.

Table 12.19 Water Released to Rajasthan and MP in 1994/95 to 2009/10

S. No.	Year	GS Dam Discharge, cusecdays	RPS Dam Discharge, cusecdays	JS Dam Discharge, cusecdays	RMC Discharge, cusecdays	LMC Discharge, cusecdays	Total, cusecdays	Water Delivered to MP, cusecdays	Water A/c of MP		Water A/c of Raj	
									cusecdays	Maf	cusecdays	Maf
1	2	3	4	5	6	7	8	9	10	11	12	13
1	1994-95	1,110,559	1,517,152	1,562,980	1,019,554	225,101	1,244,655	571,277	671,000	1.33086	573,655	1.13778
2	1995-96	1,092,404	1,452,378	1,484,144	948,984	230,350	1,179,334	524,551	674,884	1.33086	504,450	1.00052
3	1996-97	1,326,527	1,469,836	1,486,019	1,025,500	229,536	1,255,036	547,885	704,195	1.3967	550,841	1.09253
4	1997-98	1,148,256	1,251,958	1,280,884	859,771	191,020	1,050,791	422,616	567,816	1.1262	482,975	0.93793
5	1998-99	2,069,801	1,293,957	1,316,697	953,927	231,535	1,185,462	416,915	582,209	1.15475	603,253	1.19649
6	1999-00	1,178,020	1,077,650	976,938	752,389	185,574	937,963	262,625	388,465	0.77048	549,498	1.08987
7	2000-01	284,202	502,326	549,246	410,090	68,675	478,765	191,776	290,693	0.55672	198,072	0.39285
8	2001-02	368,910	810,855	821,491	618,332	126,007	744,339	306,150	453,917	0.90029	294,502	0.58411
9	2002-03 [1]	Famine										
10	2003-04	667,842	744,563	778,203	527,053	133,748	660,801	253,885	436,632	0.86601	224,169	0.44461
11	2004-05	1,465,184	1,239,361	1,294,482	911,384	203,308	1,114,692	455,879	662,166	1.31334	452,526	0.89754
12	2005-06	565,056	894,807	965,030	667,024	142,626	809,650	306,720	500,320	0.99233	309,340	0.61354
13	2006-07	2,776,050	2,756,188	2,892,831	1,484,925	232,678	1,717,603	1,254,440	565,008	1.12060	638,822	1.2670
14	2007-08	2,046,719	2,107,016	2,048,263	1,041,530	271,979	1,313,509	480,110	600,128	1.19030	713,381	1.41490
15	2008-09	693,037	1,228,244	1,359,550	753,942	200,501	954,443	352,060	435,724	0.8642	517,894	1.0272
16	2009-10	338,280	476,335	522,818	329,722	93,471	425,193	140,419	159,248	0.3159	263,745	0.5231

Note:[1] Year 2002-03 famine

12.4.2 Proposed Further Development

Rajasthan State is considering additional utilization of Chambal River water in the following projects:

- Kalisindh project, (on-going) on Kalisindh River in Jhalarapatan Tehsil of Jhalawar District for irrigation as well as for thermal power plant project. The live storage of the proposed dam is 130 Mm^3, of which 86 Mm^3 will be used for irrigation.
- Parwan major irrigation cum water supply proposed on Parwan River near Akwad Kalan village in Jhalawar District.
- Rajgarh irrigation project, in Jhalawar District.
- Manoharthana project in Jhalawar district
- Dhaulpur Lift Irrigation Scheme near Sagarpada village, about 3 kms from Dhaulpur town in Dhaulpur District.
- Indira Lift Irrigation Scheme on Chambal River at Rameshwar Ghat in Khandar Tehsil in Sawai Madhopur district.
- Ripalda Lift Irrigation Scheme from Chambal River in Khandar Tehsil of Sawai Madhopur district.
- Andheri Project in Baran district.
- Hathiadeh Irrigation Project in Baran district.
- Chambal-Panchana-Jaggar Lift Project in Karauli district.
- Transfer of water from Mej River (tributary of Chambal River) to Ramgarh Dam in Jaipur District.
- Transfer of water from Chambal River to Jaisamand Dam in Alwar District.

A decision taken in the 12th meeting of MRICB held on 03rd June 1999 authorised the utilization of surplus water in Chambal Basin for any project, a State could use yield from its own catchment plus 10% of the yield of the catchment in the territory of the other State, subject to the following conditions:

Projects having no submergence in other State
In such cases, no clearance from the other State will be necessary and it will be presumed that the other State has no objection to the project.

The implementing State shall not start construction of such project till it submits a detailed survey reports in all such cases to the other State duly certified that there is no submergence in the other State.

Projects having submergence in other state
In case there is any submergence, a detailed project report will be prepared and submitted to the partner State for obtaining clearance in case the submergence is up to 5%. Either State will send a detailed project report for information. If the submergence is more than 5% clearance from either State will be necessary.

The implementing State shall submit the detailed survey reports in all such cases to the other State. The implementing State shall not start construction of such projects until detailed project report is prepared and submitted to the partner State and clearance finally received.

12.5 Mahi River System

Mahi River Basin in Rajasthan is an interim section of the entire river's watershed. The River originates in Madhya Pradesh state, enters Rajasthan where it has a sizable additional watershed-giving rise to several tributaries, and then leaves Rajasthan to Gujarat State. The account in this report relates to the portion of the River Basin that lies within Rajasthan.

12.5.1 General Setup

Mahi River has its source in Amarkantak hills of Vindhyan Range in the Amzara area in Dar district of Madhya Pradesh (MP). After flowing for some 120 kms in MP towards north-west, it enters Rajasthan. In Rajasthan the river bends and then turns back in south-west direction to enter Gujarat after traversing for some 180 kms.

The river is fed by monsoon with about 800 mm of average rainfall, which used to cause havoc in years when the rainfall was up to 1,800 mm. On the other extreme, drought years brought misery to population whose main occupation is agriculture that rely on irrigation.

There are two major dams on Rajasthan's Mahi River, the Mahi Bajaj Sagar dam, soon after the river enters Rajasthan and Kadana Dam at the exit of the river from the State.

Mahi Bajaj Sagar Project has three units, viz:

- Unit-I, comprising a masonry dam in the river portion and earth dam on the flanks;
- Unit-II comprises of the canals system;
- Unit-III envisages harnessing the power potential of the river since the dam is located some 16 kms north-east of Banswara town.

Initially it was proposed to utilise 1,587.53 Mm^3 (1.28 Maf) water from the reservoir, out of which 1,133.95 Mm^3 (0.92 Maf) was reserved for Gujarat and 453.58 Mm^3 (0.37 Maf) for Rajasthan to irrigate a CCA of 80,000 ha. The FRL of the dam has been kept at 280.75 m (921.0 ft); additional flap of 0.75 m has been added in the existing gates to conserve more flood water in monsoon, with consent of MP.

The physical system comprises the following components:

- Main dam,
- Intake structure and power house (PH-I),
- Tail race tunnel and channel and balancing reservoir (BR-I),
- Right Main Canal (RMC),
- Left Main Canal (LMC),
- Balancing reservoir II (BR-II),
- Power House II (PH-II) and,

- Bhungara Canal

According to revised hydrological studies, 75% yield of the catchment area is 1,661.52 Mm^3, out of which 368.53 is to be set aside for utilization in Madhya Pradesh (1961 Agreement). It is expected that 25% of the water utilised in MP will flow back to Mahi Bajaj Sagar as "regenerated water" and the net dependable yield at Mahi Bajaj Sagar site is thus 1,378.0 Mm^3. The live storage capacity of Mahi Bajaj Sagar reservoir has been kept at 1,713.68 Mm^3 corresponding to FRL of 280.75 m and MDDL of 259.00 m. The carry over storage increase the available effective yield to 1,587.53 Mm^3, accordingly the share of Rajasthan becomes 453.58 Mm^3/yr, values for other dependabilities are shown below. Out of the total share of Rajasthan 255.14 Mm^3 is to be utilized for irrigation and 198.44 Mm^3 is to be kept in Dam for ensuring firming of Power generation in the lean years.

Dependability Level	25%	50%	75%	90%	Mean
Rajasthan's Share in Mahi waters at Mahi Bajaj Sagar, Mm^3/yr	856.84	611.83	453.58	346.21	699.62

As Narmada Project (see Section 12.6) takes shape, the Mahi River basin in Gujarat will obtain water from Narmada, and two-third of Mahi River water available at Kadana reservoir will be taken to the arid region of Jalore and Barmer districts through a high level Kadana Canal.

12.5.2 Utilization of Water Potential

The available water in Mahi dam is used for irrigation in Rajasthan through canal network and in Gujarat through Kadana dam and Wanak-Bori pickup weir. Sharing of water in the two states is done in a ratio of 40:16. A statement showing the water release to Gujarat before and after commencement of the powerhouses from 1985 to 2010/11 is given in Table 12.20.

Table 12.20: Water Release to Gujarat Before and after Commencement of Power Houses

S. No.	Year	Max. Level in Monsoon Period, m	Gross Storage at Max. Level, Mm^3	Live Storage at Max. from PH-I, Mm^3	Water Release to Gujarat, Mm^3			Remarks
					Kagdi Spillway after Generation of PH-I	Power House II	Total	
1	2	3	4	5	6	7	8	9
1	1985-86	276.80	1,570.31	1,223.71	625.38	0.00	625.38	[1]
2	1986-87	280.70	2,057.70	1,709.97	1,202.16	0.00	1,202.16	
3	1987-88	280.00	1,966.72	1,619.84	1,240.87	0.00	1,240.87	
4	1988-89	281.50	2,180.40	1,966.72	1,165.78	153.79	1,319.57	[2]
5	1989-90	276.65	1,547.57	1,207.49	151.18	702.00	853.18	
6	1990-91	280.75	2,065.18	1,713.17	687.45	763.37	1,450.82	
7	1991-92	280.75	2,065.18	1,713.17	584.86	786.98	1,371.84	

S. No.	Year	Max. Level in Monsoon Period, m	Gross Storage at Max. Level, Mm^3	Live Storage at Max. from PH-I, Mm^3	Water Release to Gujarat, Mm^3			Remarks
					Kagdi Spillway after Generation of PH-I	Power House II	Total	
1	2	3	4	5	6	7	8	9
8	1992-93	275.40	1,442.43	1,085.92	89.03	391.23	480.26	
9	1993-94	280.75	2,065.18	1,713.17	626.91	979.28	1,606.19	
10	1994-95	280.75	2,065.18	1,713.17	931.45	1,016.91	1,948.36	
11	1995-96	280.75	2,065.18	1,713.17	292.88	817.39	1,110.27	
12	1996-97	280.75	2,065.18	1,713.17	584.49	953.74	1,538.23	
13	1997-98	280.75	2,065.18	1,713.17	529.24	914.10	1,443.34	
14	1998-99	280.75	2,065.18	1,713.17	321.28	741.11	1,062.39	
15	1999-00	270.15	958.21	1,713.17	179.87	119.04	298.91	
16	2000-01	266.02	672.10	326.63	0.88	100.10	100.98	
17	2001-02	271.20	1,047.21	700.76	1.61	114.68	116.29	[3]
18	2002-03	266.90	722.08	378.03	3.00	0.00	3.00	
19	2003-04	281.50	2,180.40	1,833.52	65.55	569.65	635.20	
20	2004-05	281.50	2,180.40	1,833.52	217.84	661.20	879.04	
21	2005-06	280.50	2,039.15	1,692.21	23.76	235.09	258.85	
22	2006-07	281.50	2,180.40	1,833.52	707.18	393.72	1,100.90	
23	2007-08	281.50	2,180.40	1,833.52	542.10	497.87	1,039.97	
24	2008-09	273.75	1,271.23	924.26	6.88	112.45	119.33	
25	2009-10	275.00	1,394.12	1,047.16	11.78	102.08	113.86	
26	2010-11	274.35	1,332.73	985.85	0.00	50.97	50.97	

[1] Commencement of power house I in Feb. 1986
[2] Commencement of power house II in Feb. 1989
[3] 113.27 Mm^3 released from dead storage (under sluices)

12.6 Narmada System

Narmada River originates near Amarkantak in the Shahdol district of Madhya Pradesh (MP) at an elevation of about 900 m amsl and travels about 1,312 kms before joining the Gulf of Cambay in the Arabian Sea. The first 1,077 kms are in MP and last 161 kms in Gujarat. Of the remaining length, 35 kms forms a common boundary between MP and Maharashtra and another 39 kms between Gujarat and Maharashtra. The length of the river up to Sardar Sarovar dam is 1,163 kms. The state-wise distribution of the catchment area is as follows:

Madhya Pradesh	85,858 km^2
Maharashtra	1,658 km^2
Gujarat	9,894 km^2
Total	**97,410 km^2**

The drainage area up to the Sardar Sarovar dam site is 88,000 km^2 and the average annual rainfall in the basin is 1,120 mm. Narmada Water Disputes Tribunal (NWDT) assessing the utilisable water at the dam site at 75%

dependability being 28 Maf (34,537.44 Mm^3) gave its award in December 1979 regarding allocation of water between the party States as given in Table 12.21.

Table 12.21: Allocation of Narmada System Water by NWDT in December 1979

Party State	Apportionment of Water		
	Maf	Mm^3	Share
Madhya Pradesh	18.25	22,511.01	65.2%
Gujarat	9.00	11,101.32	32.1%
Rajasthan	0.50	616.74	1.8%
Maharashtra	0.25	308.37	0.9%
Total	**28.00**	**34,537.44**	**100.0%**

The above allocation relates to actual withdrawals and not the consumptive use. It was also decided that within their share of water, each party State is free to modify the water use pattern in the areas to be benefitted.

Applied statistics of water yield at Sardar Sarovar Dam is given in Table 12.22.

Table 12.22: Applied Statistics for Sardar Sarovar Dam

Annual Runoff at Dam Site	Entire Dam			Rajasthan Share, Mm^3	
	Mham	Mm^3	Mm^3/km^2	At Sardar Sarovar Dam	At Rajasthan Border
Mean	4.83	48,333	0.549	887.17	858.92
Dependability 25%	5.77	57,738	0.656	1,059.80	1026.05
Dependability 50%	4.10	41,000	0.466	752.58	728.61
Dependability 75%	3.36	33,600	0.382	616.74	597.10
Dependability 90%	2.44	24,400	0.277	447.87	433.61

Narmada Main Canal (NMC), which is the backbone of the water distribution system in Gujarat, originates at Sardar Sarovar Dam in Gujarat and after traversing some 458 kms enters Rajasthan near Silu village in Sanchore Tehsil of Jalore district. The canal is designed to convey a maximum discharge of 40,000 cusec (1,133.55 m^3/sec) with FSL of 300 ft (91.44 m) at the delivery head regulator. This is gradually curtailed to 2,600 cusec (74.55 m^3/sec) at the Gujarat-Rajasthan border, where the FSL in the canal has been fixed at RL 147.5 ft (44.97 m).

The work on the construction of Narmada Canal system in Rajasthan is currently ongoing. Water for this system has come to Rajasthan from Narmada main canal in Gujarat, the length of which up to Rajasthan border is 458 kms. However, since November 2008 Rajasthan State has been receiving water for the part of the system that has already been constructed.

The Government of Rajasthan plans to utilise its share of the Narmada water within the State by means of a 74 kms long main canal and 1,719 kms long distribution system. There are 9 major flow distributaries, 2 sub-flow

distributaries and 128 minors and sub-minors in the 'flow' canal system. There are 3 lift canal distributaries with 118 minor canals in the 'lift' system.

The system will provide irrigation and drinking water supply in Jalore and Barmer Districts of Rajasthan. It will cover a Gross Command Area (GCA) of 2.86 Lakh ha, of which 2.46 Lakh ha is Cultivable Command Area (CCA). The project also envisages supply of drinking water to some 1,336 villages situated around the canal. Rajasthan started receiving water from Narmada Canal from March 2008.

12.7 Imported Surface Water at various Dependability

Table 12.23(a) summarises the water availability for Rajasthan under different inter-State agreements at different dependability levels. Further basin-wise details of imported surface water are presented in Table 12.23(b).

Table 12.23(a): Imported Surface Water Availability to Rajasthan as per inter-State Agreements, Mm^3/yr

Source	Mean	25%	50%	75%	90%
A. Rivers Ravi-Beas-Sutlej					
IGNP Stage I	4,428	6,018	4,132	3,110	2,645
IGNP Stage II	4,934	6,698	4,598	3,461	2,944
Gang Canal	1,776	1,910	1,740	1,650	1,610
Bhakhra Canal	1,998	2,138	2,020	1,836	1,607
Sidhmukh-Nohar Canal Areas	580	621	586	533	466
Total A	**13,716**	**17,385**	**13,076**	**10,590**	**9,272**
B. River Yamuna	1,119	1,337	1,078	916	671
C. River Narmada	887	1,060	753	617	448
Total A to C	**15,722**	**19,782**	**14,907**	**12,123**	**10,391**
D. River Chambal, at Kota Barrage	3,387	4,332	2,950	1,973	1,352
E. River Mahi, at Mahi Bajaj Sagar	700	857	612	454	346
Total A to E	**19,809**	**24,971**	**18,469**	**14,550**	**12,089**
F. River Ghaggar, flood water	489	658	372	186	73
Total A to F	**20,298**	**25,629**	**18,841**	**14,736**	**12,162**

Table 12.23(b): Basin-wise Present Imported Surface Water Availability to Rajasthan, Mm^3/yr

Basin	Mean	25%	50%	75%	90%
Shekhawati	Nil				
Ruparail	18.42	22.01	17.74	15.08	11.05
Banganga	32.08	38.34	30.90	26.26	19.24
Gambhir	Nil				
Parbati	Nil				
Sabi	Nil				
Banas	Nil				
Chambal	3,387.00	4,332.00	2,950.00	1,973.00	1,352.00

Basin	Mean	25%	50%	75%	90%
Mahi	699.62	856.84	611.83	453.58	346.21
Sabarmati	Nil				
Luni	663.77	792.92	563.06	461.43	335.09
West Banas	Nil				
Sukli	Nil				
Other Nallahs of Jalore	195.15	233.13	165.55	135.67	98.52
Ghaggar	2225.13	2779.57	2134.25	1749.89	1532.82
Outside	10797.07	13727.23	10280.25	8303.26	7268.88

12.8 Shortage of Imported Water Received in Rajasthan

12.8.1 Recent Water Sharing Statements

In all the said agreements, Rajasthan is at the tail end of every system and consequently there is a shortage in supply, as the upper riparian States take more water.

The following committees have been constituted to regulate the supply to the participant States:

- Technical Committee of Bhakhra Beas Management Board (BBMB), for Ravi-Beas and Sutlej projects.
- Standing Committee Nr. 2 of Madhya Pradesh - Rajasthan Interstate Board (for Chambal water).
- Mahi Control Board, for Mahi waters.
- Upper Yamuna River Board (UYRB), for Yamuna water.

In these forums, Rajasthan claims for the delivery of its current shares, but since the release of supplies is done by the States where the headworks exist, shortages are created in Rajasthan.

Table 12.24 presents the overall water utilization, in %, by partner States as analysed on the basis of data supplied by UYRB for the given years. Table 12.25, Table 12.26 and Table 12.27 show the shortages caused to Rajasthan year-wise by relevant systems. Table 12.28 presents the recent history of Chambal River water sharing, and Table 12.29 is similar, but for Narmada Canal waters.

Table 12.24: Water Utilization by Partner States, %

State	Haryana	Rajasthan	UP	Delhi	HP
Allocation as per MoU	48	9	34	6	3
Water utilized in the years					
2000-01	73	3	22	3	
2001-02	73	3	21	3	
2002-03	75	3	19	3	
2003-04	68	2	27	3	

Table 12.24: Water Utilization by Partner States, %

State	Haryana	Rajasthan	UP	Delhi	HP
2004-05	69	2	25	4	
2005-06	71	1	25	3	
2006-07	70	2	25	3	
2007-08	70	3	25	3	

Table 12.25: Abstract of Ravi Beas Water Account of Partner States as per BBMB (all values in Maf)

Period & Year	Punjab				Rajasthan				Haryana			
	Share	Share limited to indent	Deliveries	Excess/ shortage	Share	Share limited to indent	Deliveries	Excess/ shortage	Share	Share limited to indent	Deliveries	Excess/ shortage
1	2	3	4	5	6	7	8	9	10	11	12	13
2002-03												
Filling	2.120	2.120	3.334	1.214	1.900	1.900	2.190	0.290	0.597	0.431	0.418	-0.013
Depletion	2.475	2.375	2.652	0.277	2.969	2.969	3.751	0.782	1.014	0.991	0.958	-0.033
Total	4.595	4.495	5.986	1.491	4.869	4.869	5.941	1.072	1.611	1.422	1.376	-0.046
2003-04												
Filling	2.590	2.590	4.040	1.450	2.666	2.530	2.713	0.183	0.926	0.610	0.497	-0.113
Depletion	2.664	2.505	3.216	0.711	3.280	3.280	3.991	0.711	1.146	1.088	1.087	-0.001
Total	5.254	5.095	7.256	2.161	5.946	5.810	6.704	0.894	2.072	1.698	1.584	-0.114
2004-05												
Filling	2.111	2.111	3.151	1.040	1.884	1.884	1.585	-0.299	0.591	0.525	0.518	-0.007
Depletion	2.686	2.080	3.112	1.032	3.399	3.393	4.048	0.655	1.212	1.212	1.059	-0.153
Total	4.797	4.191	6.263	2.072	5.283	5.277	5.633	0.356	1.803	1.737	1.577	-0.160
2005-06												
Filling	2.843	2.776	3.865	1.089	3.079	2.931	2.993	0.062	1.103	0.791	0.698	-0.093
Depletion	3.008	2.731	3.177	0.446	4.058	4.024	4.781	0.757	1.494	1.409	1.326	-0.083
Total	5.851	5.507	7.042	1.535	7.137	6.955	7.774	0.819	2.597	2.200	2.024	-0.176
2006-07												
Filling	2.441	2.401	3.279	0.878	2.423	1.953	2.520	0.567	0.822	0.518	0.430	-0.088
Depletion	2.876	2.409	2.904	0.495	3.907	3.906	5.149	1.243	1.420	1.385	1.352	-0.033
Total	5.317	4.810	6.183	1.373	6.330	5.859	7.669	1.810	2.242	1.903	1.782	-0.121
2007-08												
Filling	2.850	2.796	3.681	0.885	3.091	3.091	3.082	-0.009	1.108	0.949	0.758	-0.191
Depletion	2.629	2.543	3.194	0.651	3.224	3.210	3.650	0.440	1.122	1.122	1.040	-0.082

Table 12.25: Abstract of Ravi Beas Water Account of Partner States as per BBMB (all values in Maf)

Period & Year	Punjab				Rajasthan				Haryana			
	Share	Share limited to indent	Deliveries	Excess/ shortage	Share	Share limited to indent	Deliveries	Excess/ shortage	Share	Share limited to indent	Deliveries	Excess/ shortage
1	2	3	4	5	6	7	8	9	10	11	12	13
Total	5.479	5.339	6.875	1.536	6.315	6.301	6.732	0.431	2.230	2.071	1.798	-0.273
2008-09												
Filling	2.294	2.175	3.109	0.934	2.183	1.995	2.150	0.155	0.719	0.541	0.486	-0.055
Depletion	3.200	2.467	2.829	0.362	4.158	4.157	5.447	1.290	1.523	1.429	1.399	-0.030
Total	5.494	4.642	5.938	1.296	6.341	6.152	7.597	1.445	2.242	1.970	1.885	-0.085
2009-10												
Filling	2.058	2.002	2.990	0.988	1.797	1.797	1.717	-0.080	0.553	0.409	0.347	-0.062
Depletion	2.207	2.114	2.760	0.646	2.536	2.536	2.440	-0.096	0.828	0.591	0.580	-0.011
Total	4.265	4.116	5.750	1.634	4.333	4.333	4.157	-0.176	1.381	1.000	0.927	-0.073

Table 12.26: Abstract of Shares and Utilization by Partner States of Sutlej Water as per BBMB (all values in Maf)

Year & period	Sharable Supplies	Share of Partner States					Deliveries / Utilization					Excess / Shortage to Rajasthan		Supplies in RF-SF Link
		Punjab	Haryana	Rajasthan			Punjab	Haryana	Rajasthan					
				Via Punjab	Via Haryana	Total			Via Punjab	Via Haryana	Total	Via Punjab	Via Haryana	
1	2	3	4	5(a)	5(b)	5(c)	6	7	8(a)	8(b)	8(c)	9(a)	9(b)	10
2002-03														
Filling	4.655	2.601	1.576	0.301	0.177	0.478	3.294	1.710	0.068	0.120	0.188	-0.233	-0.057	0.208
Depletion	5.471	2.943	1.968	0.359	0.203	0.562	2.979	2.331	0.384	0.156	0.540	0.025	-0.047	0.158
Total	10.126	5.544	3.544	0.660	0.380	1.040	6.273	4.041	0.452	0.276	0.728	-0.208	-0.104	0.366
2003-04														
Filling	4.560	2.557	1.528	0.299	0.176	0.475	3.189	1.607	0.280	0.133	0.413	-0.019	-0.043	0.077
Depletion	6.490	3.369	2.415	0.444	0.262	0.706	3.840	2.729	0.455	0.217	0.672	0.011	-0.045	0.124
Total	11.050	5.926	3.943	0.743	0.438	1.181	7.029	4.336	0.735	0.350	1.085	-0.008	-0.088	0.201
2004-05														
Filling	3.523	2.040	1.133	0.220	0.130	0.350	2.195	1.217	0.192	0.074	0.266	-0.028	-0.056	0.039
Depletion	3.431	1.884	1.211	0.207	0.129	0.336	1.612	1.512	0.375	0.115	0.490	0.168	-0.014	0.082
Total	6.954	3.924	2.344	0.427	0.259	0.686	3.807	2.729	0.567	0.189	0.756	0.140	-0.070	0.121
2005-06														
Filling	3.901	2.152	1.334	0.261	0.154	0.415	2.670	1.498	0.278	0.104	0.382	0.017	-0.050	0.072
Depletion	5.655	2.826	2.214	0.376	0.239	0.615	3.348	2.640	0.490	0.206	0.696	0.114	-0.033	0.089
Total	9.556	4.978	3.548	0.637	0.393	1.030	6.018	4.138	0.768	0.310	1.078	0.131	-0.083	0.161
2006-07														
Filling	5.543	3.300	1.795	0.282	0.166	0.448	3.548	1.864	0.300	0.119	0.419	0.018	-0.047	0.047
Depletion	5.917	3.218	2.090	0.383	0.226	0.609	2.776	2.585	0.610	0.233	0.843	0.227	0.007	0.083
Total	11.460	6.518	3.885	0.665	0.392	1.057	6.324	4.449	0.910	0.352	1.262	0.245	-0.040	0.130
2007-08														
Filling	4.637	2.697	1.479	0.290	0.171	0.461	2.825	1.534	0.311	0.124	0.435	0.021	-0.047	0.048
Depletion	5.385	2.930	1.903	0.347	0.205	0.552	2.800	2.253	0.442	0.187	0.629	0.095	-0.018	0.008
Total	10.022	5.627	3.382	0.637	0.376	1.013	5.625	3.787	0.753	0.311	1.064	0.116	-0.065	0.056
2008-09														
Filling	4.163	2.309	1.413	0.277	0.164	0.441	2.730	1.553	0.285	0.148	0.433	0.008	-0.016	0.018

Year & period	Sharable Supplies	Share of Partner States					Deliveries / Utilization					Excess / Shortage to Rajasthan		Supplies in RF-SF Link
		Punjab	Haryana	Rajasthan			Punjab	Haryana	Rajasthan					
				Via Punjab	Via Haryana	Total			Via Punjab	Via Haryana	Total	Via Punjab	Via Haryana	
1	2	3	4	5(a)	5(b)	5(c)	6	7	8(a)	8(b)	8(c)	9(a)	9(b)	10
Depletion	5.348	2.693	2.051	0.380	0.224	0.604	3.051	2.371	0.564	0.282	0.846	0.184	0.058	0.089
Total	9.511	5.002	3.464	0.657	0.388	1.045	5.781	3.924	0.849	0.430	1.279	0.192	0.042	0.107
2009-10														
Filling	4.835	2.754	1.594	0.306	0.180	0.486	2.987	1.686	0.307	0.126	0.433	0.001	-0.054	0.018
Depletion	5.182	2.906	1.764	0.322	0.190	0.512	2.720	2.046	0.356	0.153	0.509	0.034	-0.037	0.032
Total	10.017	5.660	3.358	0.628	0.370	0.998	5.707	3.732	0.663	0.279	0.942	0.035	-0.091	0.050

Table 12.27: Utilization Statement of Yamuna Water in Bharatpur District (all values in cuseddays, unless specified)

Year and Month	Water availability at Okhala	Rajasthan Share	Rajasthan Share as per UYRB, %	Water Release by UP			Water Received in Rajasthan			Water availability in respect of Rajasthan release from Okhala, %	Water availability in respect of release by UP, %	Water availability in respect of UP release in Gurgaon Canal, %	Water availability in respect of UP release in Bharatpur Feeder, %
				Bharatpur Feeder	Gurgaon Main Canal	Total	Bharatpur Feeder	Gurgaon Main Canal	Total				
1	2	3	4	5	6	7	8	9	10	11	12	13	14
2005													
Jan	11,712	2,495	21.30	0	2,650	2,650	578	580	1,158	46.41	43.70	21.89	
Feb	14,640	3,145	21.48	2,080	1,900	3,980	909	1,101	2,010	63.91	50.50	57.95	43.70
Mar	13,086	2,879	22.00	874	2,575	3,449	1,204	1,694	2,898	100.66	84.02	65.79	137.76
Apr	9,828	2,161	21.99	640	4,350	4,990	63	3,223	3,286	152.06	65.85	74.09	9.84
May	8,563	1,887	22.04	1,664	1,950	3,614	1,288	1,057	2,345	124.27	64.89	54.21	77.40
Jun	8,240	1,813	22.00	908	1,420	2,328	820	375	1,195	65.91	51.33	26.41	90.31
Jul	43,527	6,528	15.00	3,678	105	3,783	698	424	1,122	17.19	29.66	403.81	18.98
Aug	51,633	7,740	14.99	1,363	2,900	4,263	686	1,093	1,779	22.98	41.73	37.69	50.33
Sep	35,388	5,308	15.00	896	3,750	4,646	1,341	1,116	2,457	46.29	52.88	29.76	149.67
Oct	28,963	4,345	15.00	0	450	450	0	370	370	8.52	82.22	82.22	
Nov	13,484	2,832	21.00	1,158	300	1,458	2,150	193	2,343	82.73	160.70	64.33	185.66
Dec	9,179	1,930	21.03	1,352	1,250	2,602	772	396	1,168	60.52	44.89	31.68	57.10
Total	248,243	43,063	17.35	14,613	23,600	38,213	10,509	11,622	22,131	51.39	57.91	49.25	71.92
2006													
Jan	9,937	2,086	20.99	1,863	350	2,213	191	0	191	9.16	8.63	0.00	10.25
Feb	8,751	1,836	20.98	1,045	0	1,045	786	0	786	42.81	75.22		75.22
Mar	7,204	1,613	22.39	2,461	1,800	4,261	948	255	1,203	74.58	28.23	14.17	38.52
Apr	5,789	1,272	21.97	0	1,650	1,650	0	1,450	1,450	113.99	87.88	87.88	
May	13,186	2,056	15.59	1,040	1,550	2,590	300	470	770	37.45	29.73	30.32	28.85
Jun	16,396	6,000	36.59	2,661	1,500	4,161	1,240	491	1,731	28.85	41.60	32.73	46.60
Jul	34,191	6,200	18.13	2,331	2,550	4,881	1,016	212	1,228	19.81	25.16	8.31	43.59
Aug	77,479	6,200	8.00	NR	4,650	4,650	2,154	738	2,892	46.65	62.19	15.87	
Sep	23,980	6,000	25.02	2,788	2,300	5,088	1,584	445	2,029	33.82	39.88	19.35	56.81

Year and Month	Water availability at Okhala	Rajasthan Share	Rajasthan Share as per UYRB, %	Water Release by UP			Water Received in Rajasthan			Water availability in respect of Rajasthan release from Okhala, %	Water availability in respect of release by UP, %	Water availability in respect of UP release in Gurgaon Canal, %	Water availability in respect of UP release in Bharatpur Feeder, %
				Bharatpur Feeder	Gurgaon Main Canal	Total	Bharatpur Feeder	Gurgaon Main Canal	Total				
1	2	3	4	5	6	7	8	9	10	11	12	13	14
Oct	20,771	3,122	15.03	0	4,350	4,350	60	1,163	1,223	39.17	28.11	26.74	
Nov	8,399	1,762	20.98	1,840	1,025	2,865	1,100	18	1,118	63.45	39.02	1.76	59.78
Dec	9,221	1,934	20.97	751	1,750	2,501	790	214	1,004	51.91	40.14	12.23	105.19
Total	235,304	40,081	17.03	16,780	23,475	40,255	10,169	5,456	15,625	38.98	38.82	23.24	60.60
2007													
Jan	4,491	1,032	22.98	650	403	1,053	0	0	0	0.00	0.00	0.00	0.00
Feb	6,844	1,395	20.38	1,800	2,577	4,377	906	1,287	2,193	157.20	50.10	49.94	50.33
Mar	5,749	1,283	22.32	4,300	312	4,612	1,279	253	1,532	119.41	33.22	81.09	29.74
Apr	14,530	3,197	22.00	4,500	1,927	6,427	2,132	741	2,873	89.87	44.70	38.45	47.38
May	17,830	3,827	21.46	2,400	856	3,256	982	255	1,237	32.32	37.99	29.79	40.92
Jun	25,709	5,657	22.00	1,500	1,003	2,503	0	1,159	1,159	20.49	46.30	115.55	0.00
Jul	39,077	5,862	15.00	3,350	4,984	8,334	98	1,521	1,619	27.62	19.43	30.52	2.93
Aug	80,028	9,005	11.25	4,050	7,283	11,333	301	2,271	2,572	28.56	22.69	31.18	7.43
Sep	35,181	5,279	15.01	2,900	2,221	5,121	565	1,379	1,944	36.83	37.96	62.09	19.48
Oct	2,427	400	16.48	4,350	NR	4,350	2,120	290	2,410	602.50	55.40		48.74
Nov	18,938	3,554	18.77	2,700	310	3,010	813	156	969	27.27	32.19	50.32	30.11
Dec	20,109	4,224	21.01	300	4,937	5,237	76	2,646	2,722	64.44	51.98	53.60	25.33
Total	270,913	44,715	16.51	32,800	26,813	59,613	9,272	11,958	21,230	47.48	35.61	44.60	28.27
2008													
Jan	17,849	3,711	20.79	2,691	2,250	4,941	882	19	901	24.28	18.24	0.84	32.78
Feb	15,398	3,233	21.00	1,742	1,950	3,692	599	6	605	18.71	16.39	0.31	34.39
Mar	8,427	1,851	21.97	2,969	1,050	4,019	2,646	0	2,646	142.95	65.84	0.00	89.12
Apr	15,986	3,516	21.99	1,001	5,450	6,451	481	1,979	2,460	69.97	38.13	36.31	48.05
May	16,267	3,579	22.00	873	2,150	3,023	1,302	906	2,208	61.69	73.04	42.14	149.14
Jun	36,952	8,127	21.99	3,244	2,400	5,644	1,331	1,380	2,711	33.36	48.03	57.50	41.03
Jul	60,680	9,102	15.00	5,261	4,650	9,911	1,846	1,871	3,717	40.84	37.50	40.24	35.09

Year and Month	Water availability at Okhala	Rajasthan Share	Rajasthan Share as per UYRB, %	Water Release by UP			Water Received in Rajasthan			Water availability in respect of Rajasthan release from Okhala, %	Water availability in respect of release by UP, %	Water availability in respect of UP release in Gurgaon Canal, %	Water availability in respect of UP release in Bharatpur Feeder, %
				Bharatpur Feeder	Gurgaon Main Canal	Total	Bharatpur Feeder	Gurgaon Main Canal	Total				
1	2	3	4	5	6	7	8	9	10	11	12	13	14
Aug	69,707	10,458	15.00	5,873	4,600	10,473	3,161	2,191	5,352	51.18	51.10	47.63	53.82
Sep	41,737	6,262	15.00	4,428	1,800	6,228	2,293	564	2,857	45.62	45.87	31.33	51.78
Oct	14,742	2,210	14.99	0	4,650	4,650	7	1,827	1,834	82.99	39.44	39.29	
Nov	45,173	9,485	21.00	4,429	2,400	6,829	2,961	1,577	4,538	47.84	66.45	65.71	66.85
Dec	28,957	6,082	21.00	0	1,500	1,500	2,858	450	3,308	54.39	220.53	30.00	
Total	371,875	67,616	18.18	32,511	34,850	67,361	20,367	12,770	33,137	49.01	49.19	36.64	62.65
2009													
Jan	23,505	4,934	20.99	2,954	4,000	6,954	2,173	36	2,209	44.77	31.77	0.90	73.56
Feb	16,814	3,530	20.99	1,386	1,900	3,286	381	454	835	23.65	25.41	23.89	27.49
Mar	14,472	3,185	22.01	3,782	1,300	5,082	1,092	141	1,233	38.71	24.26	10.85	28.87
Apr	17,062	3,759	22.03	2,008	2,200	4,208	402	493	895	23.81	21.27	22.41	20.02
May	14,149	3,116	22.02	1,980	2,100	4,080	1,007	127	1,134	36.39	27.79	6.05	50.86
Jun	14,599	3,114	21.33	699	2,500	3,199	814	621	1,435	46.08	44.86	24.84	116.45
Jul	19,025	2,854	15.00	0	2,050	2,050	0	196	196	6.87	9.56	9.56	
Aug	23,954	3,596	15.01	0	3,450	3,450	259	0	259	7.20	7.51	0.00	
Sep	64,516	9,677	15.00	5,408	3,400	8,808	2,656	1,511	4,167	43.06	47.31	44.44	49.11
Oct	18,143	2,725	15.02	2,607	4,650	7,257	778	2,519	3,297	120.99	45.43	54.17	29.84
Nov	5,315	1,114	20.96	3,084	166	3,250	1,079	576	1,655	148.56	50.92	346.99	34.99
Dec	15,133	3,177	20.99	1,703	900	2,603	867	148	1,015	31.95	38.99	16.44	50.91
Total	246,687	44,781	18.15	25,611	28,616	54,227	11,508	6,822	18,330	40.93	33.80	23.84	44.93
2010													
Jan	12,989	2,726	20.99	2,154	900	3,054	1,937	33	1,970	72.27	64.51	3.67	89.93
Feb	13,057	2,766	21.18	1,404	1,650	3,054	802	275	1,077	38.94	35.27	16.67	57.12
Mar	12,749	2,804	21.99	1,878	2,600	4,478	1,101	1,498	2,599	92.69	58.04	57.62	58.63
Apr	8,442	1,857	22.00	3,390	1,500	4,890	2,319	1,156	3,475	187.13	71.06	77.07	68.41
May	9,065	1,993	21.99	1,741	2,000	3,741	955	461	1,416	71.05	37.85	23.05	54.85

Year and Month	Water availability at Okhala	Rajasthan Share	Rajasthan Share as per UYRB, %	Water Release by UP			Water Received in Rajasthan			Water availability in respect of Rajasthan release from Okhala, %	Water availability in respect of release by UP, %	Water availability in respect of UP release in Gurgaon Canal, %	Water availability in respect of UP release in Bharatpur Feeder, %
				Bharatpur Feeder	Gurgaon Main Canal	Total	Bharatpur Feeder	Gurgaon Main Canal	Total				
1	2	3	4	5	6	7	8	9	10	11	12	13	14
Jun	11,511	2,533	22.01	633	2,000	2,633	195	823	1,018	40.19	38.66	41.15	30.81
Jul	40,162	6,024	15.00	2,459	3,650	6,109	667	581	1,248	20.72	20.43	15.92	27.12
Aug	66,850	10,029	15.00	4,929	3,350	8,279	1,772	1,455	3,227	32.18	38.98	43.43	35.95
Sep	20,764	3,119	15.02	862	1,450	2,312	452	848	1,300	41.68	56.23	58.48	52.44
Oct	7,360	1,112	15.11	0	0	0	268	460	728	65.47			
Nov	10,975	2,306	21.01	2,321	0	2,321	1,381	378	1,759	76.28	75.79		59.50
Dec	24,366	5,117	21.00	493	700	1,193	132	0	132	2.58	11.06	0.00	26.77
Total	238,290	42,386	17.79	22,264	19,800	42,064	11,981	7,968	19,949	47.07	47.43	40.24	53.81
2011													
Jan	26,293	5,311	20.20	1,102	2,550	3,652	849	0	849	15.99	23.25	0.00	77.04
Total	26,293	5,311	20.20	1,102	2,550	3,652	849	0	849	15.99	23.25	0.00	77.04

Table 12.28: Chambal Water Release to MP and Rajasthan for the last 14 years (1994/95 to 2009/10)

S. No.	Year	GS Dam disch. in cusec days	RPS Dam disch. in cusec days	JS Dam disch. in cusec days	RMC disch. in cusec days	LMC disch. in cusec days	Total in cusec days	Water delivered to M.P. in cusec days	Water A/c. of M.P. in cusecs days	Water A/c. of M.P. in M.A.F.	Water A/c. of Raj. in cusecs days	Water account of Raj. In M.A.F.
1	1994-95	1110559	1517152	1562980	1019554	225101	1244655	571277	671000	1.33086	573655	1.13778
2	1995-96	1092404	1452378	1484144	948984	230350	1179334	524551	674884	1.33086	504450	1.00052
3	1996-97	1326527	1489836	1486019	1025500	229536	1255036	547885	704195	1.3967	550841	1.09253
4	1997-98	1148256	1251398	1280884	859771	191020	1050791	422616	567816	1.1262	482975	0.95793
5	1998-99	2069801	1293957	1316697	953927	231535	1185462	416915	582209	1.15475	603253	1.19649
6	1999-2000	1178020	1077650	976933	752389	185574	937963	262625	388465	0.77048	549498	1.08987
7	2000-01	284202	502326	549246	410090	68675	478765	191776	290693	0.55672	198072	0.39285
8	2001-02	368910	810855	821491	618332	126007	744339	306150	453917	0.90029	294502	0.58411
9	2003-04	667842	744563	778203	527053	133748	660801	253885	436632	0.86601	224169	0.4461
10	2004-05	1465184	1239361	1294482	911384	203308	1114692	455879	662166	1.31334	452526	0.89754
11	2005-06	565056	894807	965030	667024	142626	809650	306720	500320	0.99233	309340	0.61354
12	2006-07	2776050	2756188	2892831	1484925	232678	1717603	1254440	565008	1.1206	638822	1.2670
13	2007-08	2046719	2107016	2048263	1041530	271979	1313509	480110	600128	1.1903	713381	1.4149
14	2008-09	693037	1228244	1359550	753942	200501	954443	352060	435724	0.8642	517894	1.0272
15	2009-10	338280	476335	522818	329722	95471	425193	140419	159248	0.3159	263745	0.5231

Table 12.29: Water Received through Narmada Canal as of March 2008

Month/ Year	Indent of Water, cusecdays	Water received	
		cusecdays	Mm^3
Mar-08	500	172	0.42
Apr-08	3000	577	1.41
May-08	3100	1293	3.16
Jun-08	3000	1115	2.73
Jul-08	3100	785	1.92
Aug-08	3100	1233	3.02
Sep-08	3000	1096	2.68
Oct-08	3100	1281	3.13
Nov-08	6700	1574	3.85
Dec-08	8100	3149	7.70
Jan-09	4650	2679	6.55
Feb-09	4200	610	1.49
Mar-09	4650	2005	4.90
Apr-09	5200	1590	3.89
May-09	6200	1012	2.48
Jun-09	4000	4020	9.83
Jul-09	3120	2370	5.80
Aug-09	2380	1250	3.06
Sep-09	6650	6605	16.16
Oct-09	6650	4659	11.40
Nov-09	7500	2424	5.93
Dec-09	7750	5071	12.40
Jan-10	7500	7855	19.21
Feb-10	5850	6485	15.86
Mar-10	3000	2555	6.25
Apr-10	0	0	0.00
May-10	4750	3415	8.35
Jun-10	4100	3913	9.57
Jul-10	2560	3129	7.65
Aug-10	830	968	2.37
Sep-10	450	477	1.17
Oct-10	1965	1155	2.83
Nov-10	2600	2590	6.34
Dec-10	13900	9135	22.34
Jan-11	11400	10355	25.33
Feb-11	10950	10536	25.77
Mar-11	8900	8845	21.63
Apr-11	3650	4147	10.14
May-11	7300	4345	10.63
Jun-11	7500	3780	9.25

Month/ Year	Indent of Water, cusecdays	Water received	
		cusecdays	Mm^3
Jul-11	4750	5325	13.02
Aug-11	3300	4899	11.98
Sep-11	1150	3573	8.74
Oct-11	0	1660	4.06
Nov-11	11300	9483	23.20
Dec-11	19825	18338	44.85
Jan-12	17700	14033	34.32
Feb-12	13050	12288	30.06
Mar-12	6350	8909	21.79
Apr-12	3000	5759	14.09
May-12	3100	4992	12.21
Jun-12	3000	3661	8.95

12.8.2 Imported Water during 2009-10

Table 12.30 summarises the import of water to Rajasthan from other States during year 2009-10.

Table 12.30: Water Received from other States during 2009-10

State	Period	Quantity, Mm^3/yr
Punjab		
Ravi – Beas waters	2009-10	5,133.0
Sutlej waters	2009-10	1,163.0
Haryana (Yamuna waters)	Jan 2010 to Dec 2010	19.5
Uttar Pradesh (Yamuna waters)	Jan 2010 to Dec 2010	29.3
Madhya Pradesh (Chambal waters)	2009-10	390.0
Madhya Pradesh (Mahi waters)	2009-10	803.6
Gujarat (Narmada canal)	Jan 2010 to Dec. 2010	101.9
	Total	**7640.3**

13. Groundwater Availability

13.1 Introduction

Groundwater is a major contributor to the water needs of the State. More than 80% of drinking water and almost all industrial water needs, and more than 60% of the State's irrigation water requirements are met from groundwater. The stage of groundwater development is commensurate with the rise of the population and its living standard, industrial growth and agricultural production.

The hydrogeology and occurrence of groundwater greatly varies from one river-basin to another and within the basins, owing to a great variation in topography, drainage, rainfall and geological setup.

The Consultants have carried out a thorough review of available information on the hydrogeology of Rajasthan, the aquifer properties and groundwater occurrence and flow regimes, its quality and suitability for drinking and irrigation, and computed the natural replenishment and the safe yields which can be sustained under present condition.

This aspect has been studied in detail Basin-wise/Sub basin-wise in Final Report No. 4.2 and Block-wise/District-wise in Final Report No. 4.4.

13.2 Data Collection and Validation

13.2.1 Data Collection

Two main sources of groundwater data were used for the purpose of this work: (1) data from the Central Groundwater Board (CGWB), which includes 1,588 observation wells and (2) data from Rajasthan Groundwater Department (RGWD), which includes 7611 observation wells.

The data includes exploratory tubewells and peizometer drilling data of CGWB which contains information on depth of well drilled, static water level, well yield, aquifer parameters such as transmissivity and storativity of the aquifers and chemical quality of groundwater. Data also includes information on depth of exploratory tubewells and peizometers drilled by State Ground Water Department, their water yielding capacity, drawdown and chemical quality etc. Well data were rearranged into the following main databases.

* General Information, including

Well code, coordinates, administrative location (District, Block, village), ground elevation, formations tapped, type of well, source of data.

* Hydrologic Parameters

Parameters of aquifers collected from results of pumping tests, previous work and published reports of CGWB and RGWD.

* Groundwater Levels

Groundwater level data of pre and post monsoon seasons, both as depth to water below the ground level and ground water elevations in respect of above mean sea level (amsl) for the period 1984 to 2010, were collected from CGWB and RGWD.

* Groundwater Quality Parameters

Groundwater chemical analysis data in all 33 districts of the state for the periods 1984 to 2010 were collected from CGWB and RGWD.

* Groundwater Draft (Abstraction)

The information was collected from (1) CGWB and RGWD periodically published reports on "Dynamic Groundwater Resources of Rajasthan", in the years 1995, 2001, 2004, 2007, 2009; (2) village-wise data of the existing wells/ tubewells were collected from respective Tehsil headquarters by the Consultants for the year 2010.

A significant part of the data collected were in the form of hard copy. Efforts, of many months, were put into typing the data and to bring them into workable spreadsheets. Other data sets received in soft copy were also in different formats and received at intervals during the course of study. All the data compiled were carefully reviewed and grouped into "excel" format for the use in the preparation of the report.

13.2.2 Data Validation

Special emphasis was given to data validation. During the screening of the raw data, several inaccuracies, missing data and mismatches in various raw files were found. The different data validation processes applied by the Consultants are described in the following sub-paragraphs. These include:

1) Errors in well code, including: missing well code, incorrect well code and duplicate well code.
2) Completion of missing data, such as formations and location errors.
3) Filling of missing reduced-level

   This mainly included completion of missing data and unification of all values to the same units (meters); all values were modified upto 2 digits after the decimal point. Missing data gaps on reduced level values were filled-in using 90-meters resolution SRTM data.

4) Location errors

   Including: coordinates mismatching the administrative location; district name mismatching the block or village name and vice versa; missing district or block or village names; missing coordinates.

Each value was cross-checked thoroughly by more than one person before final correction was introduced. Data that were updated during validation were sent for confirmation to the concerned area hydrogeologists of RGWD and CGWB.

No value was erased from the database even after corrections were made. In order to be able to recover initial values, the original data sets were saved to the next new columns which were added to the spreadsheets that include the corrected value. The same method was adopted for updating of CGWB and RGWD databases, also.

13.2.3 Completion of Missing Data

For wells that appeared in the datasheet with partially missing data, such as coordinates, formation, district, block, village, etc., data were recovered from other sources or from the maps.

Data Synchronization With Different Files

In some cases, well names and codes appeared slightly differently in different files. These mismatches could have occurred due to typing errors, differences in the spelling of locations, or errors in well identification. This necessitated a laborious task of matching between wells and giving them the same identity codes.

Data Correction

Encountered errors in data, such as well coordinates, well formation, well code, district, block or village name, etc., were mostly found during the projection of the well database on the administrative and hydrogeological maps.

Data Gaps

Groundwater throughout Rajasthan is being extensively monitored and recorded. The RGWD and CGWB data sources comprise together an impressive database of 9199 water level monitoring station. The main parameters being measured are groundwater levels and chemical quality of groundwater. However these sets, especially the groundwater quality database, have many gaps in some of the years, sometimes for few consecutive years, creating a large gap or discontinuity between the two measuring periods. The continuity of data is of prime importance for the sake of following groundwater trends and to enable to predict the future trend. Prediction might help prevention of reaching undesired deteriorated conditions.

The most important missing groundwater parameter is the draft or abstraction. The only method for keeping a sustainable groundwater management requires knowing two factors: (1) the replenished volume and (2) the exploited volume. There is no way of keeping a balanced scheme without measuring the draft. The main problem in this respect is that well are not metered for extraction. (Discharge rates and pumping hours of wells in the state are not monitored).

The published groundwater abstraction estimates are based on general figures and assumptions (not being calculated each year). Groundwater abstraction figures are being published after every 3 years in the Dynamic Resources Assessments periodic reports jointly by CGWB and RGWD (1995, 2001, 2004, 2007, 2009). Groundwater draft figures should normally be available for every year in order to be able to assess the impact of pumping on groundwater levels and qualities.

13.3 Basin-wise Hydrogeological Units

The 19 significant hydrogeological units considered for the purposes of water resources planning are described earlier in Section 2.5 and shown in Table 2.2 and Figure 2.2. The occurrence of these hydrogeological units in different river basins of Rajasthan is shown in Table 13.1.

Table 13.1: Hydrogeological Units in River Basins of Rajasthan

Basin	Hydrogeological Unit	Area, km²
Shekhawati	Gneisses	111.26
	Gneisses(B.G.C.)	168.30
	Older Alluvium	4,660.16
	Phyllite & Schist	1,201.16
	Quartzite	2,061.22
	Slate	63.54
	Younger Alluvium	1,485.25
Shekhawati Total		**9,750.88**
Ruparail	Limestone	167.46
	Older Alluvium	2,992.42
	Phyllite & Schist	34.72
	Quartzite	770.83
	Slate	68.23
Ruparail Total		**4,033.66**
Banganga	Gneisses(B.G.C.)	63.65
	Limestone	104.59
	Older Alluvium	4,886.16
	Phyllite & Schist	309.37
	Quartzite	1,848.87
	Slate	210.18
	Younger Alluvium	1,160.52
Banganga Total		**8,583.34**
Gambhir	Bhander Sandstone	1,207.12
	Older Alluvium	3,305.89
	Quartzite	180.51
Gambhir Total		**4,693.52**
Parbati	Bhander Sandstone	1,372.79
	Older Alluvium	514.29
Parbati Total		**1,887.07**
Sabi	Older Alluvium	2,603.50
	Quartzite	847.75
	Slate	25.70
	Younger Alluvium	1,046.72
Sabi Total		**4,523.67**
Banas	Bhander Sandstone	874.97
	Deccan Traps	62.56
Banas	Erinpura Granite	0.74
	Gneisses	36.56
	Gneisses(B.G.C.)	18,054.41
	Limestone	786.94
	Older Alluvium	8,315.75
	Phyllite & Schist	14,736.46

Basin	Hydrogeological Unit	Area, km²
	Quartzite	1,061.97
	Shale	1,470.48
	Younger Alluvium	1,659.43
Banas Total		**47,060.27**
Chambal	Bhander Sandstone	11,707.40
	Deccan Traps	6,746.88
	Gneisses(B.G.C.)	42.73
	Limestone	3,601.94
	Older Alluvium	4,045.55
	Phyllite & Schist	2,778.77
	Quartzite	145.18
	Shale	2,174.06
Chambal Total		**31,242.50**
Mahi	Deccan Traps	2,899.79
	Gneisses(B.G.C.)	4,847.20
	Limestone	192.16
	Phyllite & Schist	8,293.59
	Quartzite	6.32
	Shale	262.13
	Ultra Basics	109.44
Mahi Total		**16,610.63**
Sabarmati	Erinpura Granite	454.15
	Gneisses	51.87
	Phyllite & Schist	3,401.15
	Quartzite	222.94
Sabarmati Total		**4,130.12**
Luni	Bilara Limestone	1,373.11
	Erinpura Granite	4,120.53
	Gneisses	1,319.45
	Gneisses(B.G.C.)	74.88
	Jalore Granite	3,704.58
	Jurassic Sandstone	1,690.93
	Older Alluvium	28,980.33
	Phyllite & Schist	7,044.11
	Quartzite	18.39
	Rhyolite	2,688.09
	Tertiary Sandstone	4,973.59
	Vindhyan Sandstone	7,757.63
Luni	Younger Alluvium	5,556.47
Luni Total		**69,302.11**
West Banas	Erinpura Granite	760.20
	Gneisses	984.38
	Phyllite & Schist	86.76
West Banas Total		**1,831.34**
Sukli	Erinpura Granite	220.22
	Jalore Granite	220.06
	Phyllite & Schist	471.76
	Younger Alluvium	78.39
Sukli Total		**990.44**
Other Nallahs Of Jalore	Jalore Granite	20.03
	Older Alluvium	1,392.62

Basin	Hydrogeological Unit	Area, km²
	Rhyolite	3.62
	Younger Alluvium	483.98
Other Nallahs Of Jalore Total		**1,900.27**
Ghaggar	Younger Alluvium	5,201.51
Ghaggar Total		**5,201.51**
Outside Basin	Bilara Limestone	8,149.41
	Jalore Granite	1,770.02
	Jurassic Sandstone	13,522.13
	Older Alluvium	33,279.67
	Phyllite & Schist	1,877.15
	Quartzite	498.62
	Rhyolite	2,354.68
	Tertiary Sandstone	19,529.06
	Vindhyan Sandstone	18,143.97
	Younger Alluvium	31,397.77
Outside Basin Total		**130,522.48**
Grand Total		**342,263.80**

Note: As per Final Report No. 4.2

13.4 Depth to Ground Water Level

Ground water level data of CGWB & RGWD observation wells for pre-monsoon and post-monsoon of 2010 were used to develop basin level depth to water table maps. The occurrence of depth to water level in pre and post-monsoon (2010) for the State are described as follows.

13.4.1 Depth to Ground Water Level (Pre-Monsoon 2010)

Deeper groundwater levels occur in semi-consolidated sedimentary rocks in the State. Deep groundwater table areas of 60-100 m (bgl) fall in Tertiary, Jurassic and Vindhyan Sandstone aquifer units in the districts of Bikaner, Jodhpur and Jaisalmer in Northern and Western parts of Rajasthan. In the Northern and Southern parts of state, depth to ground water table (bgl) ranges from 5 m to 20 m. In central and south-western parts of State, the general ground water table (bgl) ranges from 20 m to 40 m. Shallow ground water table between 2 m to 5 m (bgl) occurs in Southern, South-eastern and Northern parts of the State. The depth to ground water level map of Rajasthan for pre-monsoon 2010 is shown in Figure 13.1.

13.4.2 Depth to Ground Water Level (Post-Monsoon 2010)

The areal distribution of deeper ground water table in post-monsoon of 2010 is more or less synonymous with pre-monsoon of 2010. The shallow ground water-table areas of less than 2 m and upto 5 m (bgl) cover large areas in southern and south-eastern parts of State that are occupied with sedimentary, metamorphic and igneous aquifer rock units as well as by quaternary alluvium aquifer units in Hanumangarh district. The depth to ground water level map of Rajasthan for post-monsoon 2010 is shown in Figure 13.2.

13.5 Static Ground Water Level and Flow Direction

Figure 13.3 presents the static ground water elevation contour map for the entire state according to RGWD and CGWB water level data of pre monsoon 2010.

Rajasthan is divided by the Aravalli mountain range into two main drainage systems: a western basin, with drainage direction to the northwest, and an eastern basin with a general drainage direction towards southeast. Highest (reported!) groundwater levels are found along the southern stretch of the Aravallies, about 950 - 1000 m amsl, and lowest ones are reported from the southwest, at the outlet of the Luni River into the Rann of Kutch, in Gujarat, less than 20m amsl. In the east, at the outlets of the different basins from Rajasthan, the water levels are between 100m and 150m amsl. The groundwater level contours along the southern stretch of the Aravallies portray a very complicated, steep pattern in the eastern flank, mainly in the south within Banas, Sabarmati and Mahi basins. In the west, there is a sharp drop from the 900 - 1000m amsl water level peaks to 300 - 350m amsl levels over a very short lap.

The complex features of the river basins east of the Aravallies are clearly different from those of the western side. The eastern side is subdivided into two huge basins (Banas, Chambal) and eight, small river basins. The main aquifers in these basin areas are the Old and Younger Alluvium overlying semi pervious to almost impervious aquifers. The depth of water level here is shallow and the alluvial aquifers intercept the other water bearing horizons and, therefore, at present there is no necessity of deep well drilling. The western system comprises two huge basins, the Luni Basin and the Outside Basin, where the main aquifers are under a thick cover of alluvium viz. the limestone, sandstone and hard-rock formations. The water level is considerably deeper as compared to the eastern part, amounting to more than 100m in the south west. These aquifers also constitute the main potential groundwater resources, although the quality is usually poor, as compared to the eastern basins. However, in the center of the Luni Basin and in the northern part of the Outside Basin, including the Ghaggar Basin, the operative aquifers are younger and older alluvium.

The lateral outlets of groundwater flows from Rajasthan, as is being portrayed in the map, takes place all around the state. In the east, there is outflow to the states of Uttar Pradesh and Haryana in the north, to Pakistan in the west and to the state of Gujarat in the south. The IGNP feeder canal contributes to the groundwater resources in the northwest, which is probably more than the groundwater losses to Pakistan.

13.6 Groundwater Quality

Figures 13.4, 13.5, 13.6 and 13.7 present the distribution of Cl, EC, NO_3 and F in the State of Rajasthan in per-monsoon 2010, respectively. Chloride concentrations range from more than 1,000 mg/l to less than 250 mg/l; Electrical Conductivity levels range from less than 750 µS/cm to more than 5,000 µS/cm; Nitrate values range from less than 45 mg/l to more than 100 mg/l and Fluoride concentration range from less than 1 mg/l to more than 1.5 mg/l. In most areas, there is a direct

correlation between the chloride concentrations and EC levels. At certain places, high Nitrate levels are associated with high chlorides or EC levels, as a result of agriculture and domestic activities (exhibited in Figure 13.4 to 13.7). Interestingly, the depth to water table maps present a generally good correlation to the Cl, EC and NO3 distribution, demonstrating the important role of the unsaturated profile as a buffer zone between the surface and the aquifer reservoir helping to prevent groundwater pollution. As mention above, the deeper groundwater surface presents generally better qualities than shallower areas. Areas with intensive flood irrigation and large evaporation may suffer from increasing Chloride concentration e.g. in Barmer, Pali and southern Jodhpur District. In the northern part of the state, IGNP transfers water of higher salinities (partially due to evaporation) to the underlying aquifers. The water recharges the aquifer and raises its salinities as indicated in the maps.

A map depicting groundwater quality contours with respect to Chloride based on CGWB/RGWD data of pre-monsoon 2010 is presented in Figure 13.4. Table 13.2 shows the district-wise area and percentage of area falling under different range of Chloride.

Table 13.2: District-wise Area and Percentage of Area falling under different range of Chloride (Pre-monsoon 2010)

District	Area (km^2) falling under Range of Chloride (mg/l)				%age of Area falling under Range of Chloride (mg/l)			
	< 250	250 - 1000	> 1000	Total	< 250	250 - 1000	> 1000	Total
Ajmer	1,560.7	4,749.5	2,172.2	8,482.4	18.4	56.0	25.6	100.0
Alwar	5,072.1	2,734.1	583.0	8,389.2	60.5	32.6	6.9	100.0
Banswara	4,332.4	150.1	1.5	4,484.0	96.6	3.3	0.0	100.0
Baran	6,231.5	720.5	57.2	7,009.2	88.9	10.3	0.8	100.0
Barmer	1,569.9	15,876.1	10,994.7	28,440.7	5.5	55.8	38.7	100.0
Bharatpur	936.7	2,323.6	1,823.5	5,083.8	18.4	45.7	35.9	100.0
Bhilwara	4,916.1	4,641.0	889.8	10,447.0	47.1	44.4	8.5	100.0
Bikaner	3,924.0	16,784.8	9,555.8	30,264.6	13.0	55.5	31.6	100.0
Bundi	4,867.3	815.2	96.3	5,778.7	84.2	14.1	1.7	100.0
Chittaurgarh	6,461.0	1,193.7	181.2	7,836.0	82.5	15.2	2.3	100.0
Churu	1,467.6	7,431.4	4,941.8	13,840.8	10.6	53.7	35.7	100.0
Dausa	2,209.6	1,144.2	72.4	3,426.2	64.5	33.4	2.1	100.0
Dhaulpur	2,264.4	676.2	104.3	3,044.8	74.4	22.2	3.4	100.0
Dungarpur	3,423.4	346.5	2.7	3,772.5	90.7	9.2	0.1	100.0
Ganganagar	2,377.8	6,163.7	2,161.7	10,703.2	22.2	57.6	20.2	100.0
Hanumangarh	1,707.3	6,227.4	1,982.9	9,917.5	17.2	62.8	20.0	100.0
Jaipur	6,376.5	4,003.8	759.3	11,139.6	57.2	35.9	6.8	100.0
Jaisalmer	2,008.5	25,038.9	11,463.9	38,511.2	5.2	65.0	29.8	100.0
Jalore	1,450.7	5,698.5	3,472.7	10,621.9	13.7	53.6	32.7	100.0
Jhalawar	5,384.6	861.7	71.5	6,317.8	85.2	13.6	1.1	100.0
Jhunjhunu	3,625.8	2,077.5	213.7	5,917.1	61.3	35.1	3.6	100.0
Jodhpur	2,920.4	13,758.5	5,988.6	22,667.5	12.9	60.7	26.4	100.0
Karauli	4,502.5	482.4	5.4	4,990.4	90.2	9.7	0.1	100.0
Kota	4,876.2	239.2	11.9	5,127.3	95.1	4.7	0.2	100.0
Nagaur	3,180.6	9,258.7	5,356.4	17,795.7	17.9	52.0	30.1	100.0
Pali	3,201.8	4,755.7	4,410.2	12,367.8	25.9	38.5	35.7	100.0

District	Area (km²) falling under Range of Chloride (mg/l)				%age of Area falling under Range of Chloride (mg/l)			
	< 250	250 - 1000	> 1000	Total	< 250	250 - 1000	> 1000	Total
Pratapgarh	3,934.5	504.2		4,438.7	88.6	11.4	0.0	100.0
Rajsamand	2,393.9	2,165.3	63.0	4,622.2	51.8	46.8	1.4	100.0
Sawai Madhopur	4,143.7	764.8	147.3	5,055.9	82.0	15.1	2.9	100.0
Sikar	4,709.7	2,918.0	99.6	7,727.4	60.9	37.8	1.3	100.0
Sirohi	2,227.4	2,451.0	448.7	5,127.1	43.4	47.8	8.8	100.0
Tonk	3,365.9	3,427.3	399.4	7,192.6	46.8	47.6	5.6	100.0
Udaipur	8,618.3	2,926.3	178.4	11,723.1	73.5	25.0	1.5	100.0
State Total	**120,243.0**	**153,309.6**	**68,711.2**	**342,263.8**	**35.1**	**44.8**	**20.1**	**100.0**

A map depicting groundwater quality contours with respect to EC based on CGWB/RGWD data of pre-monsoon 2010 is presented in Figure 13.5. Table 13.3 shows the district-wise area and percentage of area falling under different range of EC.

Table 13.3 District-wise Area and Percentage of Area falling under different range of EC (Pre-monsoon 2010)

District	Area (km²) falling under Range of Electrical Conductivity (µS/cm)					% age of Area falling under Range of Electrical Conductivity (µS/cm)				
	< 750	750-2250	2250 - 5000	> 5000	Total	< 750	750-2250	2250 - 5000	> 5000	Total
Ajmer	71.9	2712.1	3843.2	1855.3	8482.4	0.8	32.0	45.3	21.9	100.0
Alwar	756.9	5553.6	1686.9	391.8	8389.2	9.0	66.2	20.1	4.7	100.0
Banswara	3540.4	937.1	6.5	0.0	4484.0	79.0	20.9	0.1	0.0	100.0
Baran	3251.3	3592.5	128.3	37.1	7009.2	46.4	51.3	1.8	0.5	100.0
Barmer	190.3	2681.8	16408.5	9160.1	28440.7	0.7	9.4	57.7	32.2	100.0
Bharatpur	106.7	1173.2	2237.1	1566.8	5083.8	2.1	23.1	44.0	30.8	100.0
Bhilwara	1661.5	5733.0	2376.3	676.1	10447.0	15.9	54.9	22.7	6.5	100.0
Bikaner	201.9	9305.5	12581.1	8176.0	30264.6	0.7	30.7	41.6	27.0	100.0
Bundi	1058.1	4262.5	441.5	16.6	5778.7	18.3	73.8	7.6	0.3	100.0
Chittaurgarh	2069.2	5153.9	511.2	101.7	7836.0	26.4	65.8	6.5	1.3	100.0
Churu	68.5	2763.6	6730.4	4278.3	13840.8	0.5	20.0	48.6	30.9	100.0
Dausa	422.1	2161.7	756.0	86.4	3426.2	12.3	63.1	22.1	2.5	100.0
Dhaulpur	296.5	2159.4	506.6	82.2	3044.8	9.7	70.9	16.6	2.7	100.0
Dungarpur	1886.4	1750.4	135.7	0.0	3772.5	50.0	46.4	3.6	0.0	100.0
Ganganagar	301.9	3370.3	4976.1	2055.0	10703.2	2.8	31.5	46.5	19.2	100.0
Hanumangarh	58.3	4085.8	4371.7	1401.7	9917.5	0.6	41.2	44.1	14.1	100.0
Jaipur	2386.2	6028.8	2177.5	547.1	11139.7	21.4	54.1	19.5	4.9	100.0
Jaisalmer	47.7	3909.5	25493.5	9060.4	38511.2	0.1	10.2	66.2	23.5	100.0
Jalore	419.4	1994.3	5368.1	2840.1	10621.9	3.9	18.8	50.5	26.7	100.0
Jhalawar	1381.8	4735.1	187.6	13.4	6317.8	21.9	74.9	3.0	0.2	100.0
Jhunjhunu	1013.0	3626.7	990.4	286.9	5917.1	17.1	61.3	16.7	4.8	100.0
Jodhpur	244.3	6300.9	11132.8	4989.5	22667.5	1.1	27.8	49.1	22.0	100.0

District	Area (km²) falling under Range of Electrical Conductivity (µS/cm)					% age of Area falling under Range of Electrical Conductivity (µS/cm)				
	< 750	750-2250	2250 - 5000	> 5000	Total	< 750	750-2250	2250 - 5000	> 5000	Total
Karauli	1911.6	2791.9	286.6	0.2	4990.4	38.3	55.9	5.7	0.0	100.0
Kota	1755.1	3045.1	312.2	14.8	5127.3	34.2	59.4	6.1	0.3	100.0
Nagaur	45.4	2461.3	8221.7	7067.3	17795.7	0.3	13.8	46.2	39.7	100.0
Pali	736.3	3803.8	3795.1	4032.5	12367.8	6.0	30.8	30.7	32.6	100.0
Pratapgarh	2381.0	2000.2	57.5	0.0	4438.7	53.6	45.1	1.3	0.0	100.0
Rajsamand	549.7	3269.8	738.6	64.1	4622.2	11.9	70.7	16.0	1.4	100.0
Sawai Madhopur	1140.4	3164.1	643.5	107.9	5055.9	22.6	62.6	12.7	2.1	100.0
Sikar	1414.6	4471.9	1598.2	242.6	7727.4	18.3	57.9	20.7	3.1	100.0
Sirohi	565.4	3242.7	1108.0	211.0	5127.1	11.0	63.2	21.6	4.1	100.0
Tonk	500.1	4573.4	1810.3	308.8	7192.6	7.0	63.6	25.2	4.3	100.0
Udaipur	3143.0	7560.4	919.2	100.5	11723.1	26.8	64.5	7.8	0.9	100.0
State Total	**35577.0**	**124376.4**	**122538.1**	**59772.3**	**342263.8**	**10.4**	**36.3**	**35.8**	**17.5**	**100.0**

Source: CGWB and RGWD

A map depicting groundwater quality contours with respect to nitrate based on CGWB/RGWD data of pre-monsoon 2010 is presented in Figure 13.6. Table 13.4 shows the district-wise area and percentage of area falling under different range of Nitrate

Table 13.4: District-wise Area and Percentage of Area falling under different range of Nitrate (pre-monsoon 2010)

District	Area (km²) falling under Range of Nitrate (mg/l)				%age of Area falling under Range of Nitrate (mg/l)			
	< 45	45-100	> 100	Total	< 45	45-100	> 100	Total
Ajmer	3502.8	3603.5	1376.1	8482.4	41.3	42.5	16.2	100.0
Alwar	5263.8	1915.6	1209.8	8389.2	62.7	22.8	14.4	100.0
Banswara	3511.1	864.6	108.2	4484.0	78.3	19.3	2.4	100.0
Baran	6044.6	804.5	160.1	7009.2	86.2	11.5	2.3	100.0
Barmer	2287.8	4875.5	21277.4	28440.7	8.0	17.1	74.8	100.0
Bharatpur	1837.7	1726.4	1519.7	5083.8	36.1	34.0	29.9	100.0
Bhilwara	6352.1	2481.5	1613.3	10447.0	60.8	23.8	15.4	100.0
Bikaner	4338.8	7692.2	18233.6	30264.6	14.3	25.4	60.2	100.0
Bundi	4462.3	1276.7	39.7	5778.7	77.2	22.1	0.7	100.0
Chittaurgarh	4923.5	2072.6	839.9	7836.0	62.8	26.4	10.7	100.0
Churu	1909.9	3606.8	8324.1	13840.8	13.8	26.1	60.1	100.0
Dausa	2395.1	667.4	363.7	3426.2	69.9	19.5	10.6	100.0
Dhaulpur	2147.1	499.7	397.9	3044.8	70.5	16.4	13.1	100.0
Dungarpur	2733.2	801.9	237.4	3772.5	72.5	21.3	6.3	100.0
Ganganagar	3451.7	4358.9	2892.5	10703.2	32.2	40.7	27.0	100.0
Hanumangarh	1459.6	3346.3	5111.7	9917.5	14.7	33.7	51.5	100.0
Jaipur	7194.6	2621.9	1323.2	11139.6	64.6	23.5	11.9	100.0
Jaisalmer	12995.3	12115.2	13400.7	38511.2	33.7	31.5	34.8	100.0

District	Area (km²) falling under Range of Nitrate (mg/l)				%age of Area falling under Range of Nitrate (mg/l)			
	< 45	45-100	> 100	Total	< 45	45-100	> 100	Total
Jalore	2279.3	4043.2	4299.5	10621.9	21.5	38.1	40.5	100.0
Jhalawar	4420.5	1756.8	140.5	6317.8	70.0	27.8	2.2	100.0
Jhunjhunu	2944.1	1936.9	1036.1	5917.1	49.8	32.7	17.5	100.0
Jodhpur	5387.4	10415.6	6864.5	22667.5	23.8	45.9	30.3	100.0
Karauli	2965.5	1582.8	442.0	4990.4	59.4	31.7	8.9	100.0
Kota	4280.0	680.8	166.5	5127.3	83.5	13.3	3.2	100.0
Nagaur	2816.7	7069.7	7909.4	17795.7	15.8	39.7	44.4	100.0
Pali	5721.5	5036.9	1609.4	12367.8	46.3	40.7	13.0	100.0
Pratapgarh	3111.6	1308.4	18.8	4438.7	70.1	29.5	0.4	100.0
Rajsamand	2895.0	951.5	775.7	4622.2	62.6	20.6	16.8	100.0
Sawai Madhopur	1106.2	2542.1	1407.6	5055.9	21.9	50.3	27.8	100.0
Sikar	3284.8	2710.0	1732.7	7727.4	42.5	35.1	22.4	100.0
Sirohi	2658.1	1673.8	795.1	5127.1	51.8	32.6	15.5	100.0
Tonk	4786.7	1441.7	964.2	7192.6	66.6	20.0	13.4	100.0
Udaipur	6501.3	3490.0	1731.8	11723.1	55.5	29.8	14.8	100.0
State Total	**131969.8**	**101971.3**	**108322.7**	**342263.8**	**38.6**	**29.8**	**31.6**	**100.0**

Source: CGWB and RGWD

A map depicting groundwater quality contours with respect to Fluoride based on CGWB/RGWD data of pre-monsoon 2010 is presented in Figure 13.7. Table 13.5 shows the district-wise area and percentage of area falling under different range of Fluoride.

Table 13.5: District-wise Area and Percentage of Area falling under different range of Fluoride (Pre-monsoon 2010)

District	Area (km²) falling under Range of Fluoride (mg/l)				% age of Area falling under Range of Fluoride (mg/l)			
	< 1	1-1.5	> 1.5	Total	< 1	1-1.5	> 1.5	Total
Ajmer	267.7	979.9	7234.8	8482.4	3.2	11.6	85.3	100.0
Alwar	6458.4	1025.1	905.7	8389.2	77.0	12.2	10.8	100.0
Banswara	3702.2	551.0	230.8	4484.0	82.6	12.3	5.1	100.0
Baran	2725.8	2420.5	1862.9	7009.2	38.9	34.5	26.6	100.0
Barmer	4071.0	5796.9	18572.8	28440.7	14.3	20.4	65.3	100.0
Bharatpur	2854.1	1000.8	1228.9	5083.8	56.1	19.7	24.2	100.0
Bhilwara	3704.3	2033.6	4709.1	10447.0	35.5	19.5	45.1	100.0
Bikaner	14928.8	4527.8	10808.1	30264.6	49.3	15.0	35.7	100.0
Bundi	3467.2	1398.1	913.4	5778.7	60.0	24.2	15.8	100.0
Chittaurgarh	6320.0	1148.1	367.9	7836.0	80.7	14.7	4.7	100.0
Churu	7383.0	3155.7	3302.1	13840.8	53.3	22.8	23.9	100.0
Dausa	2035.4	669.8	721.0	3426.2	59.4	19.5	21.0	100.0
Dhaulpur	1833.0	681.7	530.1	3044.8	60.2	22.4	17.4	100.0
Dungarpur	2069.3	824.0	879.2	3772.5	54.9	21.8	23.3	100.0
Ganganagar	4015.8	2479.1	4208.3	10703.2	37.5	23.2	39.3	100.0
Hanumangarh	4691.9	2280.1	2945.5	9917.5	47.3	23.0	29.7	100.0

District	Area (km²) falling under Range of Fluoride (mg/l)				% age of Area falling under Range of Fluoride (mg/l)			
	< 1	1-1.5	> 1.5	Total	< 1	1-1.5	> 1.5	Total
Jaipur	6024.8	1899.9	3214.9	11139.6	54.1	17.1	28.9	100.0
Jaisalmer	2870.2	4928.6	30712.4	38511.2	7.5	12.8	79.7	100.0
Jalore	763.1	1163.7	8695.1	10621.9	7.2	11.0	81.9	100.0
Jhalawar	639.6	1613.5	4064.7	6317.8	10.1	25.5	64.3	100.0
Jhunjhunu	2713.0	1605.3	1598.8	5917.1	45.8	27.1	27.0	100.0
Jodhpur	3687.5	7274.8	11705.3	22667.5	16.3	32.1	51.6	100.0
Karauli	2337.5	1573.0	1079.9	4990.4	46.8	31.5	21.6	100.0
Kota	3535.5	1214.5	377.3	5127.3	69.0	23.7	7.4	100.0
Nagaur	256.5	410.4	17128.8	17795.7	1.4	2.3	96.3	100.0
Pali	1307.7	1776.1	9284.0	12367.8	10.6	14.4	75.1	100.0
Pratapgarh	4331.1	95.1	12.5	4438.7	97.6	2.1	0.3	100.0
Rajsamand	2179.3	1282.7	1160.2	4622.2	47.1	27.8	25.1	100.0
Sawai Madhopur	3037.4	1079.7	938.7	5055.9	60.1	21.4	18.6	100.0
Sikar	3573.9	1509.2	2644.3	7727.4	46.2	19.5	34.2	100.0
Sirohi	1386.9	1199.6	2540.6	5127.1	27.1	23.4	49.6	100.0
Tonk	1552.2	1739.4	3901.0	7192.6	21.6	24.2	54.2	100.0
Udaipur	8516.0	2310.5	896.6	11723.1	72.6	19.7	7.6	100.0
State Total	**119240.1**	**63647.9**	**159375.8**	**342263.8**	**34.8**	**18.6**	**46.6**	**100.0**

Source: CGWB and RGWD

13.7 Dynamic Groundwater Resources

13.7.1 Assessment Methodology

The methodology of village-wise dynamic groundwater resources assessment is based on application of GIS based analysis and adopting GEC (1997) methodology. The groundwater resources estimation methodology (GEC'97) which utilises water level fluctuation method is used based on concept of storage change due to differences between input and output components, where input refers to recharge from rainfall and other sources and output refer to ground water drainage and abstraction.

The methodology is as follows:

- Area of the hills having slope more than 20% was identified as Non-Potential Zones (NPZs) which was intersected with village layer and this area was not included in the assessment.
- Hydrogeological unit layer was intersected with village layer to calculate the village area falling into different hydrogeological units.
- Command area layer was intersected with village layer for identifying command and non command areas by village.
- Saline area layer was intersected with above layers for identifying saline and non-saline areas by village.

- Water level fluctuation data of RGWD and CGWB observation wells for the last 5 years (2006-2010) has been used for assessment and employing the interpolation technique in GIS platform (zonal statistics of spatial analyst tools) adopting 25 m x 25 m grid for the entire area of assessment, village-wise with respective hydrogeological unit.
- Village-wise annual ground water draft considered at the time of assessment for irrigation and domestic (monsoon and non monsoon for the year 2010) based on the village-wise data collected on number of wells in year 2010.
- Recharge considered in the assessment from other sources (Recharge from canals, surface and ground water irrigation and tanks and ponds) both for the period of monsoon and non monsoon for the year 2010.
- Similarly, the command area (monsoon and non monsoon recharge from canal) has been considered separately while carrying out the resource assessment.
- Rainfall recharge calculated using Water Level Fluctuation (WLF) method for the monsoon season for year 2010.
- Normalization of rainfall recharge calculated for monsoon season by WLF method has been done by using normal rainfall figures (1957-2010).
- In areas where negative fluctuation (Post monsoon is deeper than Pre monsoon water level) is observed, Rainfall Infiltration method has been used.
- Rainfall recharge calculated using Rainfall Infiltration Factor method both for the monsoon and non monsoon season.
- Percentage of difference calculated to consider the accepted value between normal rainfall recharge (RIF Method) and normal rainfall recharge (WLF Method) for the monsoon season.
- Finally recharge estimation computed village wise by adding (Adopted rainfall recharge and recharge from other sources both for monsoon and non monsoon season).
- Resource assessment carried out separately for the saline areas in GIS environment.

The basin/sub-basin/micro-watershed wise values were calculated from village-wise assessed values using GIS, considering villages falling fully or partially (in such cases values were taken on area proportion basis) within the basin/sub-basin/micro-watershed.

13.7.2 Basin-wise Dynamic Groundwater Resources

The total fresh and saline dynamic groundwater resources of the State for year 2010 has been estimated as 10,613.84 and 3,621.99 Mm^3/yr. Basin-wise assessed dynamic groundwater resource of the State is shown in Table 13.6. Sub-basin wise and micro-watershed wise assessed dynamic groundwater resources are presented in Appendix 8.

Table 13.6: Basin-wise Dynamic Groundwater Resources of Rajasthan (Year 2010)

S. No.	Basin	Dynamic Groundwater Resources, Mm^3	
		Fresh	Saline
1	Shekhawati	433.35	22.70
2	Ruparail	302.18	49.07

S. No.	Basin	Dynamic Groundwater Resources, Mm³	
		Fresh	Saline
3	Banganga	525.76	147.19
4	Gambhir	428.21	29.78
5	Parbati	128.50	0.00
6	Sabi	429.89	6.93
7	Banas	2,282.73	107.65
8	Chambal	1,999.54	26.33
9	Mahi	604.88	0.00
10	Sabarmati	62.98	10.93
11	Luni	1,493.18	488.99
12	West Banas	69.63	4.26
13	Sukli	51.68	0.00
14	Other Nallahs Of Jalore	115.28	0.00
15	Ghaggar	239.44	446.69
16	Outside Basin	1,446.61	2,281.47
State Total		**10,613.84**	**3,621.99**

Note: As per Final Report No. 4.2

Further, as per the CGWB/RGWD criteria the basins have been categorized under different categories based on stage of groundwater development as shown in Table 13.7 and Figure 13.8.

Table 13.7: Basin-wise Stage of Groundwater Development (Year 2010)

S. No.	Basin	Net Annual GW Availability, Mm³	Existing GW Draft for All Uses (2010), Mm³	Stage of GW Development (%)	Basin Category
1	Shekhawati	433.35	927.62	214.06	Over Exploited
2	Ruparail	302.18	482.07	159.53	Over Exploited
3	Banganga	525.76	938.08	178.42	Over Exploited
4	Gambhir	428.21	615.58	143.76	Over Exploited
5	Parbati	128.50	155.76	121.22	Over Exploited
6	Sabi	429.89	803.27	186.85	Over Exploited
7	Banas	2,282.73	3,380.23	148.08	Over Exploited
8	Chambal	1,999.54	2,236.13	111.83	Over Exploited
9	Mahi	604.88	447.37	73.96	Safe
10	Sabarmati	62.98	59.42	94.35	Critical
11	Luni	1,493.18	2,646.11	177.21	Over Exploited
12	West Banas	69.63	70.40	101.11	Over Exploited
13	Sukli	51.68	69.67	134.81	Over Exploited
14	Other Nallahs of Jalore	115.28	221.15	191.84	Over Exploited
15	Ghaggar	239.44	128.91	53.84	Safe
16	Outside Basin	1,446.61	2,019.07	139.57	Over Exploited
State as a Whole		**10,613.84**	**15,200.86**	**143.22**	**Over Exploited**

Note: As per Final Report No. 4.2

Similarly, as per the CGWB/RGWD criteria the categorization of Blocks/Districts under different categories based on stage of groundwater development is also shown in Table 13.8 and Figure 13.9.

Table 13.8: Block-wise/District-wise Stage of Groundwater Development (Year 2010)

District	Block	Net Groundwater Availability, Mm^3	Gross Draft for All Uses, Mm^3	Stage of Groundwater Development, %	Category
Ajmer	Arain	37.03	43.31	116.96	Over Exploited
Ajmer	Bhinay	38.75	47.25	121.94	Over Exploited
Ajmer	Jawaja	21.84	31.11	142.45	Over Exploited
Ajmer	Kekri	57.96	81.14	139.99	Over Exploited
Ajmer	Kishangarh	31.63	41.94	132.60	Over Exploited
Ajmer	Masuda	30.84	33.59	108.92	Over Exploited
Ajmer	Peesangan	51.67	112.43	217.59	Over Exploited
Ajmer	Srinagar	32.80	46.11	140.58	Over Exploited
District Total		**302.52**	**436.87**	**144.41**	**Over Exploited**
Alwar	Bansur	73.51	130.51	177.54	Over Exploited
Alwar	Behror	37.52	102.52	273.24	Over Exploited
Alwar	Kathumar	39.74	114.58	288.32	Over Exploited
Alwar	Kishangarh Bas	34.69	76.57	220.73	Over Exploited
Alwar	Kotkasim	47.29	89.51	189.28	Over Exploited
Alwar	Lachhmangarh	36.75	72.20	196.46	Over Exploited
Alwar	Mandawar	67.08	127.18	189.59	Over Exploited
Alwar	Neemrana	36.67	66.84	182.27	Over Exploited
Alwar	Rajgarh	28.05	50.24	179.11	Over Exploited
Alwar	Ramgarh	63.91	111.76	174.87	Over Exploited
Alwar	Reni	19.45	44.86	230.64	Over Exploited
Alwar	Thanagazi	35.03	46.54	132.86	Over Exploited
Alwar	Tijara	79.49	149.86	188.53	Over Exploited
Alwar	Umren	68.34	148.53	217.34	Over Exploited
District Total		**667.54**	**1,331.67**	**199.49**	**Over Exploited**
Banswara	Anandpuri	18.73	10.36	55.31	Safe
Banswara	Bagidora	28.01	15.81	56.44	Safe
Banswara	Banswara	47.57	29.27	61.53	Safe
Banswara	Chhoti Sarwan	15.16	7.11	46.90	Safe
Banswara	Garhi	56.70	23.87	42.10	Safe
Banswara	Ghatol	45.44	16.04	35.30	Safe
Banswara	Kushalgarh	18.54	14.02	75.62	Semi Critical
Banswara	Sajjangarh	14.01	6.81	48.61	Safe
District Total		**244.17**	**123.30**	**50.50**	**Safe**
Baran	Antah	70.31	78.76	112.02	Over Exploited
Baran	Atru	54.23	88.89	163.91	Over Exploited
Baran	Baran	70.96	133.08	187.54	Over Exploited
Baran	Chhabra	59.32	68.37	115.26	Over Exploited
Baran	Chhipabarod	57.94	92.26	159.23	Over Exploited
Baran	Kishanganj	84.53	75.66	89.51	Semi Critical
Baran	Shahbad	61.72	37.05	60.03	Safe
District Total		**458.99**	**574.07**	**125.07**	**Over Exploited**
Barmer	Balotra	17.36	24.96	143.78	Over Exploited
Barmer	Barmer	30.66	18.69	60.96	Safe
Barmer	Baytoo	7.70	16.98	220.52	Over Exploited
Barmer	Chohtan	47.25	46.88	99.22	Critical
Barmer	Dhorimanna	48.56	67.20	138.39	Over Exploited
Barmer	Sheo	16.03	25.02	156.08	Over Exploited

District	Block	Net Groundwater Availability, Mm^3	Gross Draft for All Uses, Mm^3	Stage of Groundwater Development, %	Category
Barmer	Sindhari	25.72	25.31	98.41	Critical
Barmer	Siwana	46.42	71.14	153.25	Over Exploited
District Total		**239.71**	**296.19**	**123.56**	**Over Exploited**
Bharatpur	Bayana	73.89	73.01	98.81	Critical
Bharatpur	Deeg	41.69	39.48	94.70	Critical
Bharatpur	Kaman	55.04	53.17	96.60	Critical
Bharatpur	Kumher	15.40	18.06	117.27	Over Exploited
Bharatpur	Nadbai	40.07	72.29	180.41	Over Exploited
Bharatpur	Pahari	41.74	41.27	98.87	Critical
Bharatpur	Rupbas	65.85	72.57	110.21	Over Exploited
Bharatpur	Sewar	35.96	57.03	158.59	Over Exploited
Bharatpur	Weir	47.45	75.66	159.45	Over Exploited
District Total		**417.10**	**502.53**	**120.48**	**Over Exploited**
Bhilwara	Asind	33.30	54.35	163.21	Over Exploited
Bhilwara	Banera	31.14	36.12	115.99	Over Exploited
Bhilwara	Hurda	21.39	25.18	117.72	Over Exploited
Bhilwara	Jahazpur	46.74	70.20	150.19	Over Exploited
Bhilwara	Kotri	42.35	54.17	127.91	Over Exploited
Bhilwara	Mandal	42.73	50.84	118.98	Over Exploited
Bhilwara	Mandalgarh	69.51	90.26	129.85	Over Exploited
Bhilwara	Raipur	19.68	32.75	166.41	Over Exploited
Bhilwara	Sahara	20.01	27.13	135.58	Over Exploited
Bhilwara	Shahpura	53.14	65.18	122.66	Over Exploited
Bhilwara	Suwana	37.34	56.82	152.17	Over Exploited
District Total		**417.34**	**563.00**	**134.90**	**Over Exploited**
Bikaner	Bikaner	57.86	109.00	188.39	Over Exploited
Bikaner	Dungargarh	51.84	71.44	137.81	Over Exploited
Bikaner	Khajuwala	-	-	-	
Bikaner	Kolayat	40.21	31.27	77.77	Safe
Bikaner	Lunkaransar	34.21	11.26	32.91	Safe
Bikaner	Nokha	72.30	140.42	194.22	Over Exploited
District Total		**256.43**	**363.39**	**141.71**	**Over Exploited**
Bundi	Bundi	59.63	65.63	110.06	Over Exploited
Bundi	Hindoli	59.88	72.40	120.91	Over Exploited
Bundi	Keshorai Patan	119.71	96.13	80.30	Semi Critical
Bundi	Nainwa	56.03	65.60	117.08	Over Exploited
Bundi	Talera	53.78	51.14	95.09	Critical
District Total		**349.04**	**350.91**	**100.54**	**Over Exploited**
Chittaurgarh	Bari Sadri	20.71	36.81	177.74	Over Exploited
Chittaurgarh	Begun	33.36	57.56	172.54	Over Exploited
Chittaurgarh	Bhadesar	24.31	35.94	147.84	Over Exploited
Chittaurgarh	Bhainsrorgarh	26.86	36.27	135.03	Over Exploited
Chittaurgarh	Bhopalsagar	17.79	21.56	121.19	Over Exploited
Chittaurgarh	Chittaurgarh	43.59	76.72	176.00	Over Exploited
Chittaurgarh	Dungla	24.31	34.24	140.85	Over Exploited
Chittaurgarh	Gangrar	24.77	39.78	160.60	Over Exploited
Chittaurgarh	Kapasan	17.21	34.25	199.01	Over Exploited
Chittaurgarh	Nimbahera	58.32	111.57	191.31	Over Exploited

District	Block	Net Groundwater Availability, Mm^3	Gross Draft for All Uses, Mm^3	Stage of Groundwater Development, %	Category
Chittaurgarh	Rashmi	20.52	27.60	134.50	Over Exploited
District Total		**311.75**	**512.31**	**164.33**	**Over Exploited**
Churu	Churu	10.21	8.37	81.98	Safe
Churu	Rajgarh	7.01	29.65	422.97	Over Exploited
Churu	Ratangarh	30.31	24.77	81.72	Safe
Churu	Sardarshahar	62.07	23.29	37.52	Safe
Churu	Sujangarh	35.40	41.10	116.10	Over Exploited
Churu	Taranagar	-	-	-	-
District Total		**144.99**	**127.20**	**87.73**	**Semi Critical**
Dausa	Bandikui	37.58	75.38	200.59	Over Exploited
Dausa	Dausa	65.91	87.57	132.86	Over Exploited
Dausa	Lalsot	60.96	126.26	207.12	Over Exploited
Dausa	Mahwa	42.48	66.03	155.44	Over Exploited
Dausa	Sikrai	42.44	71.92	169.46	Over Exploited
District Total		**249.37**	**427.17**	**171.30**	**Over Exploited**
Dhaulpur	Bari	57.13	52.42	91.76	Critical
Dhaulpur	Baseri	72.05	77.40	107.43	Over Exploited
Dhaulpur	Dhaulpur	66.15	123.62	186.88	Over Exploited
Dhaulpur	Rajakhera	59.59	77.90	130.73	Over Exploited
District Total		**254.92**	**331.34**	**129.98**	**Over Exploited**
Dungarpur	Aspur	40.38	18.40	45.57	Safe
Dungarpur	Bichhiwara	21.58	18.96	87.86	Semi Critical
Dungarpur	Dungarpur	14.79	13.31	89.99	Semi Critical
Dungarpur	Sagwara	21.83	16.91	77.46	Semi Critical
Dungarpur	Simalwara	40.91	32.69	79.91	Semi Critical
District Total		**139.48**	**100.27**	**71.89**	**Semi Critical**
Ganganagar	Anupgarh	82.18	7.63	9.28	Safe
Ganganagar	Ganganagar	59.28	35.40	59.72	Safe
Ganganagar	Gharsana	29.28	5.85	19.98	Safe
Ganganagar	Karanpur	40.22	25.18	62.61	Safe
Ganganagar	Padampur	22.65	14.90	65.78	Safe
Ganganagar	Raisinghnagar	18.46	9.54	51.68	Safe
Ganganagar	Sadulshahar	20.75	8.62	41.54	Safe
Ganganagar	Suratgarh	17.42	13.38	76.81	Safe
District Total		**290.23**	**120.50**	**41.52**	**Safe**
Hanumangarh	Bhadra	21.78	14.68	67.40	Safe
Hanumangarh	Hanumangarh	53.90	46.53	86.33	Safe
Hanumangarh	Nohar	6.58	5.89	89.51	Safe
Hanumangarh	Pilibanga	52.52	39.34	74.90	Safe
Hanumangarh	Rawatsar	-	-	-	
Hanumangarh	Sangaria	16.85	10.54	62.55	Safe
Hanumangarh	Tibi	46.27	41.37	89.41	Safe
District Total		**197.89**	**158.35**	**80.02**	**Safe**
Jaipur	Amber	74.04	186.77	252.26	Over Exploited
Jaipur	Bassi	41.83	96.49	230.67	Over Exploited
Jaipur	Chaksu	51.42	76.40	148.58	Over Exploited
Jaipur	Dudu	80.89	90.15	111.45	Over Exploited
Jaipur	Govindgarh	44.80	123.01	274.58	Over Exploited

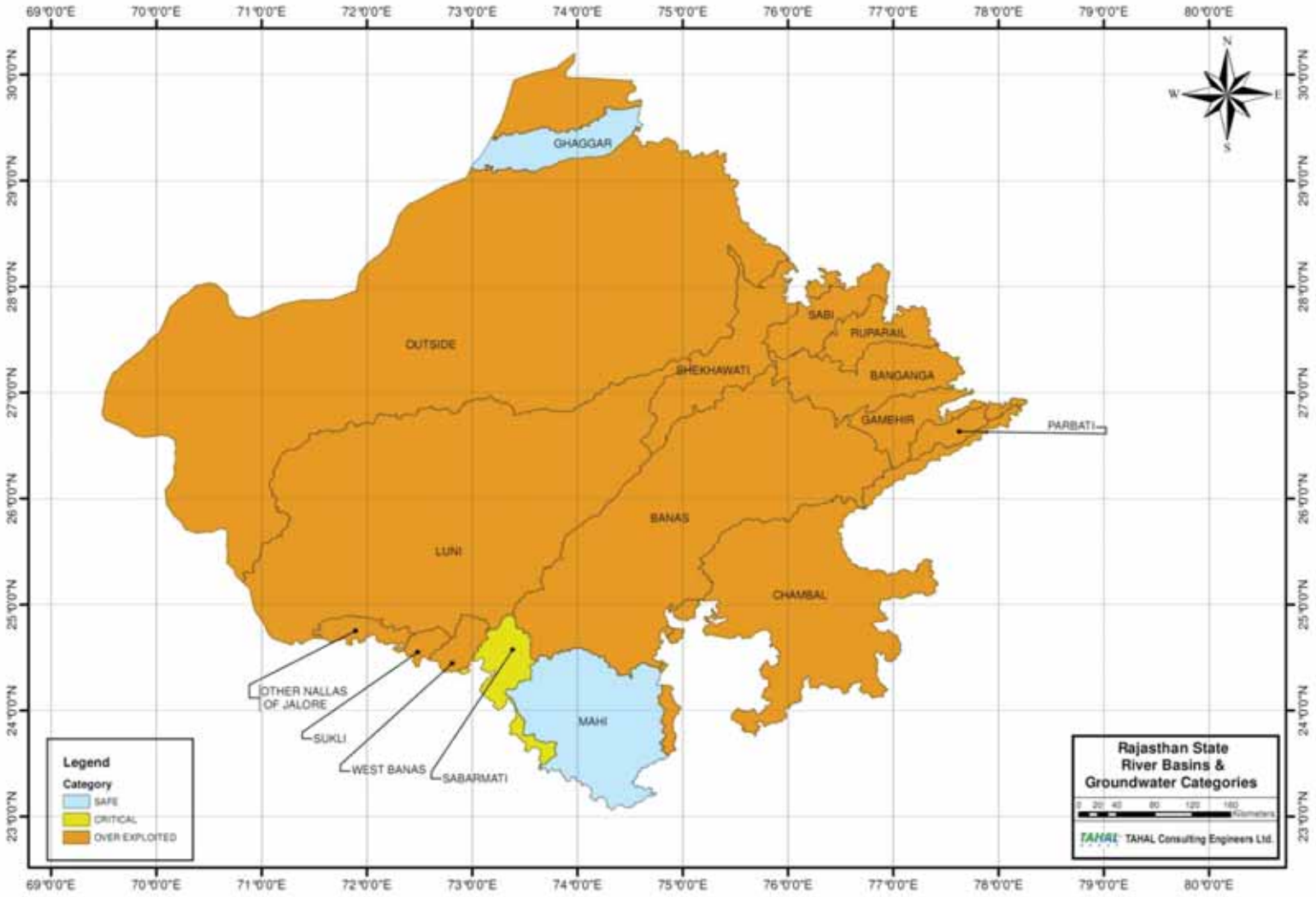
District	Block	Net Groundwater Availability, Mm^3	Gross Draft for All Uses, Mm^3	Stage of Groundwater Development, %	Category
Jaipur	Jamwa Ramgarh	57.06	93.97	164.69	Over Exploited
Jaipur	Jhotwara	49.84	245.60	492.78	Over Exploited
Jaipur	Kotputli	46.31	99.13	214.06	Over Exploited
Jaipur	Phagi	35.25	32.41	91.94	Critical
Jaipur	Sambhar	53.35	146.13	273.91	Over Exploited
Jaipur	Sanganer	46.35	124.98	269.64	Over Exploited
Jaipur	Shahpura	28.79	76.17	264.57	Over Exploited
Jaipur	Viratnagar	47.82	67.69	141.55	Over Exploited
District Total		**657.75**	**1,458.88**	**221.80**	**Over Exploited**
Jaisalmer	Jaisalmer	22.95	56.03	244.14	Over Exploited
Jaisalmer	Sam	29.42	27.86	94.70	Critical
Jaisalmer	Sankra	19.96	51.14	256.21	Over Exploited
District Total		**72.33**	**135.03**	**186.69**	**Over Exploited**
Jalore	Ahore	27.20	39.38	144.78	Over Exploited
Jalore	Bhinmal	69.12	154.14	223.00	Over Exploited
Jalore	Chitalwana	69.70	87.68	125.80	Over Exploited
Jalore	Jalore	43.32	61.41	141.76	Over Exploited
Jalore	Jaswantpura	53.93	75.10	139.25	Over Exploited
Jalore	Raniwara	58.31	122.89	210.75	Over Exploited
Jalore	Sanchore	62.69	130.61	208.34	Over Exploited
Jalore	Sayla	53.38	201.60	377.67	Over Exploited
District Total		**437.65**	**872.82**	**199.43**	**Over Exploited**
Jhalawar	Bakani	58.57	79.87	136.37	Over Exploited
Jhalawar	Dag	63.28	76.85	121.44	Over Exploited
Jhalawar	Jhalrapatan	73.14	91.97	125.75	Over Exploited
Jhalawar	Khanpur	72.77	69.91	96.07	Critical
Jhalawar	Manohar Thana	70.61	85.52	121.12	Over Exploited
Jhalawar	Pirawa	75.37	95.60	126.84	Over Exploited
District Total		**413.75**	**499.71**	**120.78**	**Over Exploited**
Jhunjhunun	Alsisar	23.90	26.49	110.84	Over Exploited
Jhunjhunun	Buhana	28.31	56.23	198.62	Over Exploited
Jhunjhunun	Chirawa	20.98	65.03	309.96	Over Exploited
Jhunjhunun	Jhunjhunun	30.43	78.19	256.95	Over Exploited
Jhunjhunun	Khetri	30.54	50.20	164.37	Over Exploited
Jhunjhunun	Nawalgarh	38.79	108.72	280.28	Over Exploited
Jhunjhunun	Surajgarh	32.24	87.35	270.94	Over Exploited
Jhunjhunun	Udaipurwati	40.62	98.86	243.38	Over Exploited
District Total		**245.82**	**571.07**	**232.31**	**Over Exploited**
Jodhpur	Balesar	22.28	45.59	204.62	Over Exploited
Jodhpur	Bap	48.65	20.75	42.65	Safe
Jodhpur	Bawari	22.39	77.80	347.48	Over Exploited
Jodhpur	Bhopalgarh	54.16	145.16	268.02	Over Exploited
Jodhpur	Bilara	41.22	113.89	276.30	Over Exploited
Jodhpur	Luni	18.47	15.26	82.62	Semi Critical
Jodhpur	Mandore	30.57	56.17	183.74	Over Exploited
Jodhpur	Osian	52.68	204.11	387.45	Over Exploited
Jodhpur	Phalodi	46.21	65.92	142.65	Over Exploited
Jodhpur	Shergarh	30.58	53.34	174.43	Over Exploited

District	Block	Net Groundwater Availability, Mm^3	Gross Draft for All Uses, Mm^3	Stage of Groundwater Development, %	Category
District Total		**367.18**	**797.96**	**217.32**	**Over Exploited**
Karauli	Hindaun	59.85	137.34	229.47	Over Exploited
Karauli	Karauli	85.46	84.12	98.43	Critical
Karauli	Nadoti	37.37	30.65	82.02	Semi Critical
Karauli	Sapotra	95.27	103.06	108.18	Over Exploited
Karauli	Todabhim	51.99	108.89	209.44	Over Exploited
District Total		**329.94**	**464.05**	**140.65**	**Over Exploited**
Kota	Itawa	128.32	101.36	78.99	Semi Critical
Kota	Khairabad	51.39	68.50	133.29	Over Exploited
Kota	Ladpura	121.10	107.02	88.37	Semi Critical
Kota	Sangod	73.23	97.73	133.46	Over Exploited
Kota	Sultanpura	116.46	103.71	89.05	Semi Critical
District Total		**490.50**	**478.33**	**97.52**	**Critical**
Nagaur	Degana	34.87	55.45	159.02	Over Exploited
Nagaur	Didwana	52.99	91.44	172.56	Over Exploited
Nagaur	Jayal	52.76	55.25	104.72	Over Exploited
Nagaur	Kuchaman City	70.16	199.05	283.71	Over Exploited
Nagaur	Ladnu	30.38	30.09	99.05	Critical
Nagaur	Makrana	41.06	51.55	125.55	Over Exploited
Nagaur	Merta	46.21	152.74	330.53	Over Exploited
Nagaur	Mundwa	63.11	186.99	296.29	Over Exploited
Nagaur	Nagaur	41.04	39.00	95.03	Critical
Nagaur	Parbatsar	28.00	52.36	187.00	Over Exploited
Nagaur	Riyan	51.20	62.30	121.68	Over Exploited
District Total		**511.79**	**976.23**	**190.75**	**Over Exploited**
Pali	Bali	38.63	45.95	118.95	Over Exploited
Pali	Desuri	22.65	28.67	126.58	Over Exploited
Pali	Jaitaran	53.91	72.95	135.32	Over Exploited
Pali	Marwar Junction	38.01	55.86	146.96	Over Exploited
Pali	Pali	8.48	7.63	89.98	Semi Critical
Pali	Raipur	20.22	27.25	134.77	Over Exploited
Pali	Rani	28.08	31.56	112.39	Over Exploited
Pali	Rohat	5.96	5.56	93.29	Critical
Pali	Sojat	30.97	40.30	130.13	Over Exploited
Pali	Sumerpur	32.51	31.72	97.57	Critical
District Total		**279.43**	**347.43**	**124.34**	**Over Exploited**
Pratapgarh	Arnod	34.47	46.98	136.29	Over Exploited
Pratapgarh	Chhoti Sadri	25.61	39.36	153.69	Over Exploited
Pratapgarh	Dhariawad	30.02	28.55	95.10	Critical
Pratapgarh	Peepalkhoont	14.66	10.00	68.21	Safe
Pratapgarh	Pratapgarh	42.81	70.15	163.86	Over Exploited
District Total		**147.57**	**195.03**	**132.16**	**Over Exploited**
Rajsamand	Amet	15.01	17.26	114.99	Over Exploited
Rajsamand	Bhim	11.38	15.55	136.64	Over Exploited
Rajsamand	Deogarh	10.23	11.74	114.76	Over Exploited
Rajsamand	Khamnor	22.77	25.27	110.98	Over Exploited
Rajsamand	Kumbhalgarh	18.52	21.64	116.85	Over Exploited
Rajsamand	Railmagra	16.87	20.33	120.51	Over Exploited

District	Block	Net Groundwater Availability, Mm^3	Gross Draft for All Uses, Mm^3	Stage of Groundwater Development, %	Category
Rajsamand	Rajsamand	15.52	19.58	126.16	Over Exploited
District Total		**110.30**	**131.36**	**119.09**	**Over Exploited**
Sawai Madhopur	Bamanwas	72.16	83.90	116.27	Over Exploited
Sawai Madhopur	Bonli	63.31	69.73	110.14	Over Exploited
Sawai Madhopur	Gangapur	60.16	106.37	176.81	Over Exploited
Sawai Madhopur	Khandar	80.89	83.60	103.35	Over Exploited
Sawai Madhopur	Sawai Madhopur	75.92	111.28	146.58	Over Exploited
District Total		**352.44**	**454.88**	**129.07**	**Over Exploited**
Sikar	Danta Ramgarh	48.18	84.87	176.15	Over Exploited
Sikar	Dhond	37.57	64.05	170.48	Over Exploited
Sikar	Fatehpur	50.95	42.60	83.61	Semi Critical
Sikar	Khandela	30.66	49.54	161.58	Over Exploited
Sikar	Lachhmangarh	43.70	48.60	111.21	Over Exploited
Sikar	Neem Ka Thana	32.53	45.62	140.24	Over Exploited
Sikar	Piprali	30.44	71.06	233.44	Over Exploited
Sikar	Sri Madhopur	33.98	76.02	223.72	Over Exploited
District Total		**308.00**	**482.38**	**156.62**	**Over Exploited**
Sirohi	Abu Road	26.08	25.61	98.20	Semi Critical
Sirohi	Pindwara	45.29	44.88	99.09	Semi Critical
Sirohi	Reodar	64.31	93.47	145.34	Over Exploited
Sirohi	Sheoganj	56.27	70.65	125.56	Over Exploited
Sirohi	Sirohi	62.04	74.14	119.50	Over Exploited
District Total		**253.99**	**308.75**	**121.56**	**Semi Critical**
Tonk	Deoli	78.89	72.05	91.33	Critical
Tonk	Malpura	62.41	62.90	100.79	Over Exploited
Tonk	Niwai	80.62	83.50	103.57	Over Exploited
Tonk	Todaraisingh	43.60	38.62	88.58	Semi Critical
Tonk	Tonk	94.51	83.47	88.32	Semi Critical
Tonk	Uniara	70.23	77.91	110.94	Over Exploited
District Total		**430.25**	**418.45**	**97.26**	**Critical**
Udaipur	Bargaon	11.97	13.69	114.37	Over Exploited
Udaipur	Bhindar	25.26	37.23	147.39	Over Exploited
Udaipur	Girwa	33.64	40.21	119.53	Over Exploited
Udaipur	Gogunda	24.24	28.02	115.59	Over Exploited
Udaipur	Jhadol	22.51	21.15	93.96	Critical
Udaipur	Kherwara	23.39	21.20	90.64	Critical
Udaipur	Kotra	15.92	13.23	83.10	Semi Critical
Udaipur	Lasadiya	9.51	9.29	97.69	Critical
Udaipur	Mavli	25.72	35.65	138.61	Over Exploited
Udaipur	Rishabhdeo	12.64	12.59	99.60	Critical
Udaipur	Salumbar	34.83	33.17	95.23	Semi Critical
Udaipur	Sarada	24.03	24.01	99.92	Critical
District Total		**263.67**	**289.43**	**109.77**	**Over Exploited**
State Total		**10,613.84**	**15,200.86**	**143.22**	**Over Exploited**

Note: As per Final Report No. 4.4

Figure 13.8: Basin-wise Stage of Groundwater Development



13.8 Static Groundwater Resources

13.8.1 Assessment Methodology

The static groundwater resources have been estimated by applying the following formula:

Static groundwater resources = effective potential zone area of the aquifer × utilizable saturated thickness × specific yield

Central Groundwater Board has estimated the static groundwater resources block-wise, in each hydrogeological formation in the entire State, in the years 2004 and 2008. Average depth of the basement and utilizable saturated thickness of the different hydrogeological formations have been adopted on the basis of the values as reported by the respective field hydrogeologist of the respective areas and used in the static groundwater assessment, year 2008. The static groundwater resources for the year 2010 have been calculated by adopting same criteria as indicated above.

The various parameters adopted for estimation of static groundwater resources are shown in Table 13.9.

Table 13.9: Various Parameters Adopted for Estimation of Static Groundwater Resources

Parameters	Alluvium	Sandstone	Limestone	Hard-rocks
Specific Yield	0.01 - 0.03	0.001 - 0.004	0.0015 - 0.004	0.001 - 0.003
Utilizable Percentage of Saturated Thickness (%)	10 - 40	3 - 35	5 - 35	2 - 35
Average depth of basement (m bgl)	Adopted on the basis of groundwater exploration data			

Source: CGWB & RGWD

13.8.2 Basin-wise Static Groundwater Resources

The total static ground water resources occurring below the lowest fluctuating levels of ground water as permanent resource are estimated at 32,914.18 Mm^3 for fresh areas and 29,725.51 Mm^3 for saline areas in 16 river basins (for year 2010) that comprise the State of Rajasthan as per CGWB methodology. Basin-wise position of static ground water resources for 16 basin of the State is given in Table 13.10. Sub-basin wise and micro-watershed wise assessed static groundwater resources are presented in Appendix 8.

Table 13.10: Basin-wise Static Groundwater Resources of Rajasthan (Year 2010)

S. No.	Basin	Static Groundwater Resources, Mm^3	
		Fresh	Saline
1	Shekhawati	1,196.66	130.77
2	Ruparail	472.79	107.89
3	Banganga	813.57	280.35

S. No.	Basin	Static Groundwater Resources, Mm^3	
		Fresh	Saline
4	Gambhir	478.18	56.82
5	Parbati	103.69	0.00
6	Sabi	698.56	13.69
7	Banas	1,808.90	90.42
8	Chambal	953.39	22.09
9	Mahi	108.82	0.00
10	Sabarmati	11.81	4.09
11	Luni	10,884.72	4,041.33
12	West Banas	7.44	0.89
13	Sukli	6.06	0.00
14	Other Nallahs Of Jalore	705.82	0.00
15	Ghaggar	484.60	1,120.90
16	Outside Basin	14,179.17	23,856.27
State Total		**32,914.18**	**29,725.51**

Note: As per Final Report No. 3.2

From the above table it may be observed that fresh static groundwater resources range from 6.06 Mm^3 in Sukli basin to as high as 14,179.17 Mm^3 in Outside basin which has also maximum saline groundwater resources of 23,856.27 Mm^3.

13.9 Basin-wise Groundwater Scenario

13.9.1 Shekhawati Basin

The main hydrogeological formations in the basin are Younger Alluvium, Older Alluvium, Quartzite, Phyllite & Schist, Gneisses(B.G.C.), Gneisses and Slate.

There is a decline in groundwater levels in the basin with an average rate of change of 0.45 m/yr for pre-monsoon season which is significant. As per pre-monsoon 2010 data, the groundwater levels in the basin are in the range of 40 to 50 m bgl. Deeper groundwater levels of 60 to 80 m bgl occur in Dohan and Mendha Sub-basins.

As per pre-monsoon 2010 groundwater quality data, about 11%, 37%, 19% and 31% of the basin area has more than maximum permissible (as per BIS drinking water standards) chloride, fluoride, nitrate and electrical conductivity concentrations in groundwater, respectively.

The total annually assessed fresh dynamic groundwater resource in the basin for the year 2010 is 433.35 Mm^3 against which the groundwater draft is 927.62 Mm^3. Accordingly, the stage of groundwater development in the basin is 214.06% and the basin is categorised as groundwater over-exploited basin. The saline dynamic annual groundwater resources assessed for the basin for year 2010 is 22.70 Mm^3. The assessed fresh and saline static groundwater resource in the basin for year 2010 are 1,196.66 Mm^3 and 130.77 Mm^3, respectively.

13.9.2 Ruparail Basin

The main hydrogeological formations in the basin are Older Alluvium, Quartzite, Limestone, Slate and Phyllite & Schist.

There is a decline in groundwater levels in the basin with an average rate of change of 0.05 m/yr for pre-monsoon season. As per pre-monsoon 2010 data, the groundwater levels in the basin range from less than 2 m to 40 m bgl. Relatively shallow levels of groundwater were registered in the eastern part of the Basin than its western part.

As per pre-monsoon 2010 groundwater quality data, about 17%, 17%, 18% and 44% of the basin area has more than maximum permissible (as per BIS drinking water standards) chloride, fluoride, nitrate and electrical conductivity concentrations in groundwater, respectively.

The total annually assessed fresh dynamic groundwater resource in the basin for the year 2010 is 302.18 Mm^3 against which the groundwater draft is 482.08 Mm^3. Accordingly, the stage of groundwater development in the basin is 159.53% and the basin is categorised as groundwater over-exploited basin. The saline dynamic annual groundwater resources assessed for the basin for year 2010 is 49.07 Mm^3. The assessed fresh and saline static groundwater resource in the basin for year 2010 are 472.79 Mm^3 and 107.89 Mm^3, respectively.

13.9.3 Banganga Basin

The main hydrogeological formations in the basin are Younger Alluvium, Older Alluvium, Quartzite, Phyllite & Schist, Slate, Limestone and Gneisses(B.G.C.).

There is a decline in groundwater levels in the basin with an average rate of change of 0.22 m/yr for pre-monsoon season which is significant. As per pre-monsoon 2010 data, the groundwater levels in the eastern part of the basin generally range from 5 to 20 m bgl with levels of 2 to 5 m bgl occurring in isolated pockets. In the central and southern parts of the basin, the groundwater levels generally range from 10 to 40 m bgl. Deeper groundwater levels of more than 60 m bgl depth occur along the border with Gambhir basin.

As per pre-monsoon 2010 groundwater quality data, about 18%, 19%, 21% and 15% of the basin area has more than maximum permissible (as per BIS drinking water standards) chloride, fluoride, nitrate and electrical conductivity concentrations in groundwater, respectively.

The total annually assessed fresh dynamic groundwater resource in the basin for the year 2010 is 525.76 Mm^3 against which the groundwater draft is 938.08 Mm^3. Accordingly, the stage of groundwater development in the basin is 178.42% and the basin is categorised as groundwater over-exploited basin. The saline dynamic annual groundwater resources assessed for the basin for year 2010 is 147.19 Mm^3. The assessed fresh and saline static groundwater resources in the basin for year 2010 are 813.57 Mm^3 and 280.35 Mm^3, respectively.

13.9.4 Gambhir Basin

The main hydrogeological formations in the basin are Older Alluvium, Bhander Sandstone and Quartzite.

There is a decline in groundwater levels in the basin with an average rate of change of 0.18 m/yr for pre-monsoon season which is significant. As per pre-monsoon 2010 data, the groundwater levels in the basin range from 5-20 m bgl. In western and eastern part of the basin, groundwater levels were present in the range of 20-80 m bgl. Shallow groundwater levels of 2-10 m bgl existed in northern part of the basin.

As per pre-monsoon 2010 groundwater quality data, about 5%, 18%, 21% and 22% of the basin area has more than maximum permissible (as per BIS drinking water standards) chloride, fluoride, nitrate and electrical conductivity concentrations in groundwater, respectively.

The total annually assessed fresh dynamic groundwater resource in the basin for the year 2010 is 428.21 Mm^3 against which the groundwater draft is 615.59 Mm^3. Accordingly, the stage of groundwater development in the basin is 143.76% and the basin is categorised as groundwater over-exploited basin. The saline dynamic annual groundwater resources assessed for the basin for year 2010 is 29.78 Mm^3. The assessed fresh and saline static groundwater resource in the basin for year 2010 are 478.18 Mm^3 and 56.82 Mm^3, respectively.

13.9.5 Parbati Basin

The main hydrogeological formations in the basin are Older Alluvium and Bhander Sandstone.

There is a decline in groundwater levels in the basin with an average rate of change of 0.52 m/yr for pre-monsoon season which is significant. As per pre-monsoon 2010 data, the groundwater levels in the basin range from 5-10 m bgl. Levels of more than 20 to 40 m (bgl) occurred in eastern part of the basin and in an isolated pocket in western part of the basin.

As per pre-monsoon 2010 groundwater quality data, about 1%, 13%, 5% and 10% of the basin area has more than maximum permissible (as per BIS drinking water standards) chloride, fluoride, nitrate and electrical conductivity concentrations in groundwater, respectively.

The total annually assessed fresh dynamic groundwater resource in the basin for the year 2010 is 128.50 Mm^3 against which the groundwater draft is 155.76 Mm^3. Accordingly, the stage of groundwater development in the basin is 121.21% and the basin is categorised as groundwater over-exploited basin. The saline dynamic annual groundwater resources for the basin for year 2010 is assessed as nil. The assessed fresh and saline static groundwater resource in the basin for year 2010 are 103.69 Mm^3 and nil, respectively.

13.9.6 Sabi Basin

The main hydrogeological formations in the basin are Younger Alluvium, Older Alluvium, Quartzite and Slate.

There is a decline in groundwater levels in the basin with an average rate of change of 0.45 m/yr for pre-monsoon season which is significant. As per pre-monsoon 2010 data, the groundwater levels in the basin range from 20-40 m bgl. Deeper groundwater level areas occurred as small pockets along the northern part of the basin.

As per pre-monsoon 2010 groundwater quality data, about 1%, 11%, 6% and 8% of the basin area has more than maximum permissible (as per BIS drinking water standards) chloride, fluoride, nitrate and electrical conductivity concentrations in groundwater, respectively.

The total annually assessed fresh dynamic groundwater resource in the basin for the year 2010 is 429.89 Mm^3 against which the groundwater draft is 803.27 Mm^3. Accordingly, the stage of groundwater development in the basin is 186.85% and the basin is categorised as groundwater over-exploited basin. The saline dynamic annual groundwater resources assessed for the basin for year 2010 is 6.93 Mm^3. The assessed fresh and saline static groundwater resource in the basin for year 2010 are 698.56 Mm^3 and 13.69 Mm^3, respectively.

13.9.7 Banas Basin

The main hydrogeological formations in the basin are Gneisses(B.G.C.), Phyllite & Schist, Older Alluvium, Younger Alluvium, Shale, Quartzite, Bhander Sandstone and Limestone. Other hydrogeological formations like Deccan Traps, Gneisses and Erinpura Granite occupy relatively small area in the basin.

There is a decline in groundwater levels in the basin with an average rate of change of 0.18 m/yr for pre-monsoon season which is significant. As per pre-monsoon 2010 data, the groundwater levels in the basin are in the range of 20-60 mbgl in parts of Morel and Mashi Sub-basin; 10-40 m bgl in Berach, Khari, Banas and Sodra Sub-basins. Depth to groundwater level of 5-10 m bgl occur in the central part of Banas Basin in Kothari, Khari and Banas Sub-basins. Deeper groundwater levels of 60-80 m bgl occurs only in Mashi and Morel Sub-basins.

As per pre-monsoon 2010 groundwater quality data, about 9%, 40%, 17% and 30% of the basin area has more than maximum permissible (as per BIS drinking water standards) chloride, fluoride, nitrate and electrical conductivity concentrations in groundwater, respectively.

The total annually assessed fresh dynamic groundwater resource in the basin for the year 2010 is 2,282.73 Mm^3 against which the groundwater draft is 3,380.23 Mm^3. Accordingly, the stage of groundwater development in the basin is 148.08% and the basin is categorised as groundwater over-exploited basin. The saline dynamic annual groundwater resources assessed for the basin for year 2010 is 107.65 Mm^3.

The assessed fresh and saline static groundwater resource in the basin for year 2010 are 1,808.90 Mm^3 and 90.42 Mm^3, respectively.

13.9.8 Chambal Basin

The main hydrogeological formations in the basin are Older Alluvium, Bhander Sandstone, Deccan Traps, Limestone, Phyllite & Schist, Shale, Quartzite and Gneisses(B.G.C.).

There is a decline in groundwater levels in the basin with an average rate of change of 0.13 m/yr for pre-monsoon season which can be considered significant. As per pre-monsoon 2010 data, the general groundwater levels in the basin are 2-20 m bgl. Shallow groundwater levels of less than 2-5 m bgl mostly occurs in Parwati, Mej and Chambal Upstream Sub-basins. Deeper groundwater levels of 20-60 m bgl occur in central part of Chambal Basin in the Kalisindh and Chambal Downstream Sub-basin.

As per pre-monsoon 2010 groundwater quality data, about 0.5%, 25%, 2% and 4% of the basin area has more than maximum permissible (as per BIS drinking water standards) chloride, fluoride, nitrate and electrical conductivity concentrations in groundwater, respectively.

The total annually assessed fresh dynamic groundwater resource in the basin for the year 2010 is 1,999.54 Mm^3 against which the groundwater draft is 2,236.13 Mm^3. Accordingly, the stage of groundwater development in the basin is 111.83% and the basin is categorised as groundwater over-exploited basin. The saline dynamic annual groundwater resources assessed for the basin for year 2010 is 26.33 Mm^3. The assessed fresh and saline static groundwater resource in the basin for year 2010 are 953.39 Mm^3 and 22.09 Mm^3, respectively.

13.9.9 Mahi Basin

The main hydrogeological formations in the basin are Phyllite & Schist, Gneisses(B.G.C.), Deccan Traps, Shale, Limestone, Ultra Basics and Quartzite.

There is a decline in groundwater levels in the basin with an average rate of change of 0.05 m/yr for pre-monsoon season which is not significant. As per pre-monsoon 2010 data, the general groundwater levels in the basin are 2-5 m bgl mostly in the north central and southern parts of the basin. Deeper groundwater level of 20-40 m bgl occurs as isolated pockets in Anas, Mahi, Jakham and Som Sub-basins.

As per pre-monsoon 2010 groundwater quality data, about 0.2%, 10%, 9% and 4% of the basin area has more than maximum permissible (as per BIS drinking water standards) chloride, fluoride, nitrate and electrical conductivity concentrations in groundwater, respectively.

The total annually assessed fresh dynamic groundwater resource in the basin for the year 2010 is 604.88 Mm^3 against which the groundwater draft is 447.37 Mm^3. Accordingly, the stage of groundwater development in the basin is 73.96% and the basin is categorised as groundwater safe basin. The saline dynamic annual

groundwater resources for the basin for year 2010 is assessed as nil. The assessed fresh and saline static groundwater resource in the basin for year 2010 are 108.82 Mm^3 and nil, respectively.

13.9.10 Sabarmati Basin

The main hydrogeological formations in the basin are Phyllite & Schist, Erinpura Granite, Quartzite and Gneisses.

There is a decline in groundwater levels in the basin with an average rate of change of 0.03 m/yr for pre-monsoon season which is not significant. As per pre-monsoon 2010 data, the general groundwater levels in the basin are 5-20 m bgl except few localised pockets in northern, central and southern part of basin having water level less than 5 m bgl.

As per pre-monsoon 2010 groundwater quality data, about 0%, 0.5%, 2% and 0.3% of the basin area has more than maximum permissible (as per BIS drinking water standards) chloride, fluoride, nitrate and electrical conductivity concentrations in groundwater, respectively.

The total annually assessed fresh dynamic groundwater resource in the basin for the year 2010 is 62.98 Mm^3 against which the groundwater draft is 59.42 Mm^3. Accordingly, the stage of groundwater development in the basin is 94.35% and the basin is categorised as groundwater critical basin. The saline dynamic annual groundwater resources assessed for the basin for year 2010 is 10.93 Mm^3. The assessed fresh and saline static groundwater resource in the basin for year 2010 are 11.81 and 4.09 Mm^3, respectively.

13.9.11 Luni Basin

The main hydrogeological formations in the basin are Younger Alluvium, Older Alluvium, Vindhyan Sandstone, Phyllite & Schist, Tertiary Sandstone, Erinpura Granite, Jalore Granite, Rhyolite, Jurassic Sandstone, Bilara Limestone, Gneisses, Gneisses (B.G.C.) and Quartzite.

There is a decline in groundwater levels in the basin with an average rate of change of 0.47 m/yr for pre-monsoon season which is significant. As per pre-monsoon 2010 data, the general groundwater levels in the basin are 20-40 m bgl. Deeper groundwater levels of 40-100 m bgl occur in Jojri, Luni and Sagi Sub-basins. Shallow groundwater levels, between 2-20 m bgl occur in the central part of Luni Basin in Guhiya, Bandi, Sukri and Jawai Sub-basins.

As per pre-monsoon 2010 groundwater quality data, about 37%, 73%, 47% and 76% of the basin area has more than maximum permissible (as per BIS drinking water standards) chloride, fluoride, nitrate and electrical conductivity concentrations in groundwater, respectively.

The total annually assessed fresh dynamic groundwater resource in the basin for the year 2010 is 1,493.18 Mm^3 against which the groundwater draft is 2,646.12 Mm^3. Accordingly, the stage of groundwater development in the basin is 177.21% and the

basin is categorised as groundwater over-exploited basin. The saline dynamic annual groundwater resources assessed for the basin for year 2010 is 488.99 Mm^3. The assessed fresh and saline static groundwater resource in the basin for year 2010 are 10,884.72 and 4,041.33 Mm^3, respectively.

13.9.12 West Banas Basin

The main hydrogeological formations in the basin are Gneisses, Erinpura Granite and Phyllite & Schist.

There is a decline in groundwater levels in the basin with an average rate of change of 0.16 m/yr for pre-monsoon season which can be considered significant. As per pre-monsoon 2010 data, the general groundwater levels in the basin are 10-20 m bgl except small area along borders of the basin in the eastern and southern periphery, which have registered groundwater level of 5-10 m bgl. Groundwater levels of more than 20 m bgl occur in isolated patches in the central part of the basin and along the western and south-western border of the basin.

As per pre-monsoon 2010 groundwater quality data, about 0.7%, 27%, 11% and 11% of the basin area has more than maximum permissible (as per BIS drinking water standards) chloride, fluoride, nitrate and electrical conductivity concentrations in groundwater, respectively.

The total annually assessed fresh dynamic groundwater resource in the basin for the year 2010 is 69.63 Mm^3 against which the groundwater draft is 70.41 Mm^3. Accordingly, the stage of groundwater development in the basin is 101.12% and the basin is categorised as groundwater over-exploited basin. The saline dynamic annual groundwater resources assessed for the basin for year 2010 is 4.26 Mm^3. The assessed fresh and saline static groundwater resource in the basin for year 2010 are 7.44 and 0.89 Mm^3, respectively.

13.9.13 Sukli Basin

The main hydrogeological formations in the basin are Phyllite & Schist, Erinpura Granite, Jalore Granite and Younger Alluvium.

There is a decline in groundwater levels in the basin with an average rate of change of 0.33 m/yr for pre-monsoon season which is significant. As per pre-monsoon 2010 data, the general groundwater levels in the basin are 10-20 m bgl in the eastern, northern and western part of the basin except the central and some western part of the basin where groundwater levels of more than 20 m bgl are observed.

As per pre-monsoon 2010 groundwater quality data, about 0.6%, 57%, 9% and 5% of the basin area has more than maximum permissible (as per BIS drinking water standards) chloride, fluoride, nitrate and electrical conductivity concentrations in groundwater, respectively.

The total annually assessed fresh dynamic groundwater resource in the basin for the year 2010 is 51.68 Mm^3 against which the groundwater draft is 69.69 Mm^3. Accordingly, the stage of groundwater development in the basin is 134.81% and the

basin is categorised as groundwater over-exploited basin. The saline dynamic annual groundwater resources for the basin for year 2010 is assessed as nil. The assessed fresh and saline static groundwater resource in the basin for year 2010 are 6.06 Mm^3 and nil, respectively.

13.9.14 Other Nallahs of Jalore Basin

The main hydrogeological formations in the basin are Older Alluvium, Younger Alluvium, Jalore Granite and Rhyolite.

There is a decline in groundwater levels in the basin with an average rate of change of 0.36 m/yr for pre-monsoon season which is significant. As per pre-monsoon 2010 data, the groundwater levels in the basin are deep, in the range of 20-80 m bgl in central part of the basin and relatively shallow i.e. 5-20 m bgl in the eastern and western parts of the basin.

As per pre-monsoon 2010 groundwater quality data, about 34%, 74%, 43% and 55% of the basin area has more than maximum permissible (as per BIS drinking water standards) chloride, fluoride, nitrate and electrical conductivity concentrations in groundwater, respectively.

The total annually assessed fresh dynamic groundwater resource in the basin for the year 2010 is 115.28 Mm^3 against which the groundwater draft is 221.15 Mm^3. Accordingly, the stage of groundwater development in the basin is 191.84% and the basin is categorised as groundwater over-exploited basin. The saline dynamic annual groundwater resources for the basin for year 2010 is assessed as nil. The assessed fresh and saline static groundwater resource in the basin for year 2010 are 705.82 Mm^3 and nil, respectively.

13.9.15 Ghaggar Basin

The main hydrogeological formation in the basin is Younger Alluvium.

There is a rise in groundwater levels in the basin with an average rate of change of 0.37 m/yr for pre-monsoon season. As per pre-monsoon 2010 data, the groundwater levels in the basin are in the range of 5-20 m bgl except for some local pockets where the levels are below 2 m or 2-5 m bgl in central and eastern part of the basin. Groundwater levels of more than 20 m bgl are observed in small pockets in the southern, northern and eastern part of the basin.

As per pre-monsoon 2010 groundwater quality data, about 20%, 33%, 35% and 61% of the basin area has more than maximum permissible (as per BIS drinking water standards) chloride, fluoride, nitrate and electrical conductivity concentrations in groundwater, respectively.

The total annually assessed fresh dynamic groundwater resource in the basin for the year 2010 is 239.44 Mm^3 against which the groundwater draft is 128.91 Mm^3. Accordingly, the stage of groundwater development in the basin is 53.84% and the basin is categorised as groundwater safe basin. The saline dynamic annual groundwater resources assessed for the basin for year 2010 is 446.69 Mm^3. The

assessed fresh and saline static groundwater resource in the basin for year 2010 are 484.60 and 1,120.90 Mm^3, respectively.

13.9.16 Outside Basin

The main hydrogeological formations in the basin are Older Alluvium, Younger Alluvium, Tertiary Sandstone, Vindhyan Sandstone, Jurassic Sandstone, Bilara Limestone, Rhyolite, Phyllite & Schist, Jalore Granite and Quartzite.

There is a rise in groundwater levels in the basin with an average rate of change of 0.07 m/yr for pre-monsoon season. As per pre-monsoon 2010 data, the groundwater levels in the basin are deep. Deeper levels of 20-120 m bgl occur in central, western and southern parts of the basin.

As per pre-monsoon 2010 groundwater quality data, about 29%, 53%, 44% and 76% of the basin area has more than maximum permissible (as per BIS drinking water standards) chloride, fluoride, nitrate and electrical conductivity concentrations in groundwater, respectively.

The total annually assessed fresh dynamic groundwater resource in the basin for the year 2010 is 1,446.61 Mm^3 against which the groundwater draft is 2,019.07 Mm^3. Accordingly, the stage of groundwater development in the basin is 139.57% and the basin is categorised as groundwater over-exploited basin. The saline dynamic annual groundwater resources assessed for the basin for year 2010 is 2,281.47 Mm^3. The assessed fresh and saline static groundwater resource in the basin for year 2010 are 14,179.17 and 23,856.27 Mm^3, respectively.

13.10 Comparison of Current Study's Water Availability with Earlier TAHAL-WAPCOS Study (1998)

13.10.1 Introduction

The current study follows and updates the earlier one (Water resources Planning for the State of Rajasthan, TAHAL-WAPCOS, 1998), with the following main findings regarding groundwater.

Groundwater availability was assessed according to CGWB & RGWD methodology (GEC'97), based on updated and revalidated data bridging the period of 2006-2010. According to this methodology, the groundwater recharge was assessed as related to natural replenishment from rainfall and recharge from other sources, mainly related with seepage/return flows of irrigation system. (In comparison, the earlier study the computations used rainfall data for the years 1988-1991 (inclusive) and RGWD data on depth-to-SWL at two time points: pre-Monsoon 1988 and pre-Monsoon 1992. Some adjustments were required to reflect the division of some Potential Zones vis-a-vis adjacent river basins.

The quoted values have been taken from the relevant current and earlier basin-wise appendix and relevant chapters, namely:

Sections 4 of basin appendices for groundwater of Volume 2 of Final Report No. 4.2 for the current study, and Chapters 9 of earlier respective basin reports for groundwater in the earlier study.

13.10.2 Dynamic Groundwater Availability Comparison

The Current and Earlier assessments for mean annual total availability (Dynamic) of groundwater are summarized in Table 13.11.

Table 13.11: Current to Earlier (C/E) Comparison of Assessments of Total Dynamic Groundwater Availability

S. No.	Basin	Basin Area, km^2			Mean Annual Total Dynamic Groundwater Availability, Mm^3		
		Current	Earlier	C/E	Current	Earlier	C/E
1	Shekhawati	9751	11522	0.85	456	536	0.85
2	Ruparail	4034	3855	1.05	351	275	1.28
3	Banganga	8583	8878	0.97	673	933	0.72
4	Gambhir	4694	4174	1.12	458	466	0.98
5	Parbati	1887	2388	0.79	129	240	0.54
6	Sabi	4524	4442	1.02	437	318	1.37
7	Banas	47060	45833	1.03	2,390	2,348	1.02
8	Chambal	31243	31460	0.99	2,026	2,099	0.97
9	Mahi	16611	16985	0.98	605	1,248	0.48
10	Sabarmati	4130	4164	0.99	74	84	0.88
11	Luni	69302	37363	1.85	1,982	1,277	1.55
12	West Banas	1831	1798	1.02	74	61	1.21
13	Sukli	990	947	1.05	52	59	0.88
14	Other Nallhas of Jalore	1900	1968	0.97	115	99	1.16
15	Ghaggar+Outside	135724	166464	0.82	4,414	2,336	1.89
	Entire State	**342,264**	**342,241**	**1.00**	**14,236**	**12,379**	**1.15**

As seen, there are good compatibilities in terms of assessed groundwater availability in Mm^3/yr between the Current and Earlier assessments. Although, some deviations were found which may be attributed to the reasons mentioned below:

- The classification of aquifer units is different. Therefore the number of units, their surface area and hydraulic parameters are different. This obviously affects the groundwater availability estimation.
- Higher value for Luni basin is due to increase in basin area (1.85 times as shown in Table 13.11) as compared to earlier study. This area has been shifted from Outside basin to Luni basin in current study, hence area of Outside basin has decreased.
- Even though area of Outside basin has decreased in current study as compared to earlier 1998 study, higher values for Ghaggar+Outside basin has been assessed. This can be attributed to rising water table due to return flows from surface water irrigation in both Rabi and Kharif season and less extraction of groundwater.

- The storativity values used per aquifer unit are different. For example: every difference of only 1% in the storativity projected for the entire State (320,000 km^2) for a saturated thickness of only 1m – will result a difference of 3,200 Mm^3 in the availability.
- The data record used in current study and earlier TAHAL-WAPCOS (1994-1998) study is different.
- In earlier study water level fluctuation were considered for the period 1988 to 1992 while in current study the water level fluctuation have been considered for period 2006 to 2010.
- The data interpolation method is different. Present study utilizes GIS techniques of interpolation using grid of 25 m x 25 m.
- Difference in rainfall data period. In 1998 study the rainfall duration was 1957-1993 while in present study the rainfall duration is from 1957-2010.
- Difference in irrigated area affects the return flows to groundwater. Differences in number of water tanks and length of canal systems also affect the seepage and return flows to groundwater.
- Well database is totally different due to: (a) many wells were dry by 2010 (b) many new wells (c) validation process.

14. Water Pollution

14.1 General

Rajasthan being water scarce State in the country cannot afford to pollute its scarce, but precious water resources. It has only two river basins out of 15 defined basins as perennial and majority of the rivers are not flowing and cannot perform the function of transporting the wastes discharged in them. In such situation any pollution load generated get stagnated at a place of its generation, be it air pollution depositing on land or be it water pollution accumulating on land or in dry river or even in and around urban or industrial premises, or be it solid wastes being dumped in the urban or industrial areas. Most of the industrial effluents and domestic sewage have similar fate in the State. Thus, pollution continues to build-up at a place of generation, pollutes the groundwater and reaches the threshold level. Groundwater is a major source of water for the State. The groundwater is depleting and getting polluted due to geogenic and anthropogenic sources. Groundwater once polluted cannot be easily restored. It might take several decades to get normal. Such pollution is emerging as a serious problem in many areas of Rajasthan. In such situation, rigorous treatment of the wastewater and its subsequent use is the best option in order to protect the quality of water resources in the State. The detailed district-wise Water Pollution analysis has been presented in Final Report No. 4.5.

14.2 Surface Water Quality Status and Trend

In order to keep watch on water quality and pollution level in the water bodies of the State, the Rajasthan State Pollution Control Board (RSPCB) and Central Pollution Control Board (CPCB) are regularly monitoring the water quality of rivers (12 locations) and lakes (17 nos.). Central Water Commission (CWC) also monitors the water quality of rivers but at very few locations (four rivers at five locations). The water quality data obtained by RSPCB/CPCB and CWC is analysed which indicated that the water quality is meeting the designated best use criteria most of the time. The 10 years trend also did not indicate any significant change. Although monitoring data is not available for smaller rivers in the State, such rivers downstream of major towns are in a bad shape. Only wastewater flows in these rivers like, Ahar River downstream of Udaipur, Bandi River downstream of Pali, Kothari River downstream of Bhilwara, Gambhiri and Berach rivers downstream of Chittaurgarh, and Darbhavati River downstream of Jaipur. These rivers hardly flow for few kilometres in the downstream and vanish due to percolation. Thus, such river stretches are highly polluted, having water quality, most of the time, below desired level for "designated best use". The stretches immediately downstream are carrying the massive input of wastewater from the town located on their banks. This input sets off a progressive series of chemical and biological events in the downstream water. Such stretches are characterized by high bacterial population, cloudy appearance, high BOD and strong disagreeable odour - all indicating general depletion of oxygen. Masses of gaseous sludge rising from the bottom are often noticed floating near the surface of the water. During monsoon due to flood the sludge deposited in these stretches is flushed and stay in suspension causing rise in oxygen uptake in the downstream. This may cause fish mortality during first flushing after onset of monsoon. Organic wastes from domestic sources, textile

industrial effluents, mining wastes and chemical industrial wastes are major cause of concern. Similarly, some of the lakes are also polluted due to dumping of city sewage, mass bathing, offering of flowers, and other ritual performances. The 10 years water quality monitoring data indicated that there is no definite trend of water quality. However, some of the lakes are showing improving trend particularly with respect to coliform count. This could be attributed to curtailment of sewage inflows. Organic pollution, nutrients loading and pathogenic pollution are major surface water quality issues of the State.

The water quality of Rajasthan Feeder Canal (Indira Gandhi Feeder) receiving water from Harike Barrage does not meet the primary water quality criteria with respect to category of drinking water sources without conventional treatment. Water quality is deteriorated on account of release of untreated sewage and industrial effluent from cities and towns of Punjab.

14.3 Groundwater Quality Status and Trend

The groundwater quality degradation in the State is mainly due to its over-abstraction leading to mining of contaminated water from deeper aquifers and percolation of wastes from human activities. With growing population and increasing standards of living, the demand for water is steeply increasing putting heavy pressure on groundwater resources of the State. The dumping of urban and industrial wastes without proper treatment is leading to its seepage in groundwater and polluting it. The groundwater, which is generally considered as safe is being contaminated by geogenic and anthropogenic pollution in the State. The CGWB, RGWD and PHED monitor the groundwater quality in the State. As per the findings of these agencies, the water quality is highly polluted. The major water quality issues of Rajasthan are related to salinity as reflected by electric conductivity values in water quality data, fluoride and nitrate. These pollutants are both anthropogenic and geogenic. Majority of groundwater quality related problems arise due to its contamination and over-exploitation. The full extent of damage to the aquifer is unknown but problems are ubiquitous and growing. The manmade contamination is mainly due to: i) inadequate arrangements for collection, transport, treatment and disposal of domestic and industrial wastes (gaseous, liquid and solid); ii) salinization in intensive irrigated areas; iii) natural leaching of toxic elements like fluoride from geological formations. The alarming pictures are beginning to emerge from many parts of the State. Essentially, all activities carried out on land's surface have the potential to pollute groundwater, whether associated with urban, industrial or agricultural land uses. Large scale concentrated sources of pollution, such as industrial discharges, landfills, inadequate collection of urban wastes are obvious sources of groundwater contamination. Since the groundwater is major source of drinking water and nearly 90% population of the State depends on groundwater as source of drinking water, it is important to pay serious attention on prevention of groundwater contamination and its monitoring scientifically. Most of the districts are affected by high salinity and fluoride.

Last 25 years data generated by CGWB/RGWD revealed that Nagaur has the highest average EC value followed by Barmer, Churu, Pali, Hanumangarh, Ganganagar, Jodhpur, Jaisalmer, Jalore, Bikaner, Bharatpur and Ajmer. All these

districts are having maximum EC Values ranging from 3400 to 5000 µS/cm. The minimum ranging from 120 to 650 µS/cm and maximum ranging from 5000 to 75000 µS/cm. This indicates that the groundwater in most of these districts is saline. There are only four districts e.g. Baran, Dungarpur, Banswara and Pratapgarh having average EC below 1000 µS/cm. In these districts also there are some pockets having quite high EC values. However, in general, the EC Values are within acceptable range of drinking water.

The analysis of PHED data indicated similar trend. Since PHED monitors only drinking water sources, many times these are hand-pumps drawing water from shallow aquifers and hence may not be comparable with CGWB/RGWD values, which are based on much different sources and procedure for sampling and analysis. It is observed that majority of water sources are affected by salinity as reflected in terms of TDS. As clear from the data except Ganganagar and Hanumangarh districts most of the districts are affected by high salinity. This is in contrast with the findings of CGWB/RGWD. The Hanumangarh and Ganganagar districts were having lowest EC and TDS values. Total percentage of samples having TDS ranging from 500 to 2000 mg/l was about 10%, whereas about 90% of the samples were having less than 500 mg/l of TDS. The CGWB/RGWD results indicated much higher level of EC values in these two districts. In Hanumangarh district the minimum EC values recorded during 25 years were varying between 200 and 700 µS/cm, while the maximum values varying between 17400 and 80000 µS/cm, the 25 percentile values varying between 945 and 1800 µS/cm, median values between 1655 and 3150 µS/cm and 75 percentile between 3200 and 6325 µS/cm. Similarly in Ganganagar district also CGWB/RGWD finding are quite similar to Hanumangarh district. In PHED studies majority of the values were varying between 500 to 2000 mg/l of TDS. Barmer and Bharatpur districts are most affected by salinity in PHED studies, whereas, in studies it is Nagaur and Barmer which are worst affected by salinity. In fact, it is Nagaur, Barmer, Churu, Pali, Hanumangarh, Ganganagar, Jodhpur, Jaisalmer, Jalore, Bikaner, Bharatpur and Ajmer, which are affected most in the State. Such differences in results could be due to difference in location of sampling, sampling depth and other factors affecting the groundwater quality.

From average fluoride concentration point of view the values were found highest in Jalore and Ajmer districts at 2.5 mg/l followed by Nagaur, Pali, Jodhpur, Sirohi, the values exceeding 2 mg/l. In the remaining districts the average values are below 2 mg/l. The lowest average value was recorded as below 0.5 mg/l. There are nine districts having average values less than 1 mg/l. There are 15 districts having fluoride values exceeding 1.5 mg/l. Although average fluoride values will not convey the information on magnitude of problem existing in certain pockets of the districts, it can be useful for comparison and ranking purpose. The district wise fluoride values based on box-whisker plots indicated that Nagaur is worst affected district having annual maximum values ranging from 8.48 to 65 mg/l with majority of values in the range of 0.32 to 4.2 mg/l followed by Sirohi with annual maximum values ranging from 7.2 to 54.4 mg/l and majority of values in the range of 0.44 to 3.4 mg/l, Pali with annual maximum values ranging from 7.88 to 38.4 mg/l and majority of values in the range of 0.0 to 4.4 mg/l, Jalore with annual maximum values ranging from 6.8 to 30 mg/l and majority of values in the range of 0.48 to 6.2 mg/l. All the 33 districts are affected by fluoride contamination. The problem is

low in Baran, Kota, Karauli and Pratapgarh. There was a fluctuation g trend in groundwater quality as observed through box-whisker plot for 25 years. This can be attributed to annual average rainfall in the area. The annual average rainfall has strong influence on groundwater quality as higher rainfall results in higher recharge, which in turn has dilution effect on groundwater.

The analysis of PHED data indicated that majority of water sources are affected by fluoride except Ganganagar and Hanumangarh districts. Majority of values are ranging between 1 to1.5 mg/l with some of the districts having fluoride values exceeding 1.5 mg/l. PHED data indicated that Jalore is most affected by high fluoride in groundwater followed by Pali, Sirohi, Bhilwara, Jaisalmer, Jaipur and Ajmer. Such findings again do not match with CGWB/RGWD findings. CGWB/RGWD reported much higher levels of fluoride in Hanumangarh and Ganganagar districts. The variations could be attributed to the factors explained earlier.

As far as nitrate pollution problem is concerned, as per the CGWB/RGWD data the nitrate problem is severe in one-third of the State where the values exceed the maximum permissible limits prescribed by BIS for drinking water. There are 5 districts exceeding the average nitrate concentration of 3 meq/l. The highest average nitrate concentration was observed as 4.7 meq/l in Churu district. The lowest average value was 0.5 meq/l in Banswara district. There are 3 districts having average nitrate concentration values below the desirable drinking water limit of 0.73 meq/l (45 mg/l) and 17 districts having average nitrate concentration values within the maximum permissible drinking water limit of 1.61 meq/l (100 mg/l). Since there is large variation in nitrate concentration of groundwater of different districts, it was considered to analyse the values through Box-Whisker Plots. The box-whisker plots revealed that about two-third of the groundwater sources are within the maximum permissible drinking water limit. As far as trend of water quality is concerned, there is a fluctuating trend in groundwater quality. Some of the boxes are larger in size indicating larger variation in Nitrate values as compared to other years. There is a fluctuating trend in Nitrate values reflecting effect of rainfall variation in different years. There is no definite trend in the values of CGWB/RGWD data collected over last 25 years.

The PHED data analysis indicated that nitrate is a water quality problem in many parts of the State. Some of the districts like Ajmer and Barmer are worst affected. Both these districts are having nitrate levels higher than desirable limit of drinking water prescribed by BIS in groundwater in about 60% of the samples collected by PHED. Sikar district also Nagaur, Sikar and Banswara also showed about 40% samples exceeding the limit. Rajsamand, Sawai Madhopur, Banswara, Dausa, Baran, Bharatpur, Chittaurgarh, Churu, Dhaulpur, Jaipur, Jhunjhunu, Jodhpur, Pali and Tonk districts are showing values exceeding drinking water limit between 20 to 30%. As clear from the data except Ganganagar, Hanumangarh, Kota and Bundi district are best from nitrate pollution point of view as reflected in PHED data. This is not in agreement with the CGWB/RGWD data at some places. This could be attributed to difference in sampling locations, depth of the wells sampled, procedure of sampling and analysis. Thus, it can be inferred that two-third of the groundwater sources are meeting the maximum permissible limits prescribed by BIS with respect to Nitrate. However, some of the districts are affected by

groundwater pollution. Such values may be due to either higher use of nitrogenous fertilizers in the area or due to inadequate sanitation of the domestic wastes, which may have polluted the groundwater.

14.4 Water Quality Survey

In order to get more confidence on the data obtained from different monitoring agencies and get first hand information on magnitude of water quality degradation in different parts of the State, it was decided to collect samples from some selected water bodies and analyse these samples in some recognized laboratory. About 26 samples were collected and analysed in TEAM Lab, Jaipur. There were 15 wastewater samples from different sources, 6 groundwater samples 3 lake water samples and 2 river water samples. The results indicated that the groundwater quality of Barmer district is worst affected by salinity. The TDS is as high as 5168 mg/l to 8006 mg/l, fluoride 0.6 mg/l to as high as 4.1 mg/l and accordingly the major ions also are abnormally high. These analysis results are in agreement with the findings of CGWB/RGWD and PHED. Similarly, the water quality results of samples collected from Rajsamand also are in agreement with the results obtained by CGWB/RGWD and PHED. The toxic pollutants analysed like heavy metals in the groundwater of Barmer and Rajsamand did not indicated the values exceeding the drinking water limits. In Barmer, an effluent sample collected from a RIICO industrial area showed high pH (9.58), BOD (380 mg/l), COD (2038 mg/l) extremely high EC (44308 µS/cm). All values indicated that the effluent was not meeting the stipulated norms of RSPCB. The marble slurry effluent also showed higher values of EC (5970 µS/cm), TDS 4064 mg/l. However, such high values could be attributed due to high salts in the raw water being used by the marble manufacturers. The water quality of Mansagar Lake in Jaipur was also found unfit for the lake environment, as the BOD was as high as 26 mg/l, COD 126 mg/l EC 2448 µS/cm and TDS 1297 mg/l. The tannery effluent from Manpur-Machedi Industrial area showed extremely high pollution level in the final effluent with BOD of 4200 mg/l, COD 24240 mg/l, total chromium 5.76 mg/l, TDS 23850 mg/l, EC 50500 µS/cm. These values indicated gross violation of the environmental requirements. The effluent was highly polluted. The effluent sample from the other industrial area i.e. Bagru also showed higher values of BOD (42 mg/l) than the acceptable limit of 30 mg/l. The other pollutant in this sample was in acceptable range. The water quality of Amanishah Nala near Sanganer Bridge was also found extremely polluted with BOD as high as 2600 mg/l, COD 19392 mg/l, which again indicated the effluent is grossly violating the national norms of pollution regulation. The water quality of ground water samples collected from Dudu was found in acceptable norms of drinking water, except the fluoride concentration was found 3.4 mg/l, which is much higher than the desirable and acceptable limits set by BIS for drinking water. The groundwater samples from Khetri near Hindustan Copper Smelter area were found in acceptable limits with respect to toxic metals, however, the conductivity was found 3300 µS/cm, which is slightly higher than the acceptable norm of BIS. The water quality of Jojhari river at Jodhpur was also found within limits with respect to toxic pollutants except high TDS (7240 mg/l), EC (12300 µS/cm) and Chloride (3282 mg/l). Such high level of salts may lead the river water to become saline and not fit for aquatic life, drinking water and irrigation. The water quality of Fatehsagar Lake was in acceptable limit with BOD

varying from 1.4 to 2.2 mg/l, COD 18 to 25 mg/l and is in agreement with the data of RSPCB. The samples collected from Hindustan Zinc Limited area showed acceptable values in terms of drinking water requirements and thus the water is not found polluted.

14.5 Assessment of Domestic Pollution Loads

It is observed that out of 6.86 crore people living in Rajasthan about 1.7 crore are urban as per the Census of 2011, which is almost 25%. The State is urbanizing very fast, especially large cities like Jaipur, Jodhpur and Kota are growing very fast. Wastewater generation is a function of water supply. In Rajasthan piped water supply is largely restricted to urban areas except few villages. Rural population and smaller towns still depends on community wells, hand-pumps or even rivers/ponds for their drinking water requirements. The total water supply in the Class-I cities and Class-II towns in the Rajasthan harbouring population of about 1.23 crore is about 1663 MLD and wastewater generation is about 1330 MLD. It is also observed that out of 1330 MLD of wastewater generated from Class-I cities and Class-II towns as high as 56% is generated from three metro-cities i.e. Jaipur, Jodhpur and Kota, another 35% is generated from remaining Class-I cities, where as all the Class-II towns generate only 9% of the total wastewater. The total wastewater generation from urban centres including Class-III, IV and V categories was estimated at 1798 MLD.

As per the latest Annual Report of RSPCB (RSPCB 2010), there are three cities in Rajasthan having operational sewage treatment plants facilities with a capacity of 192 MLD. Additional 7 treatment plants are under construction with a capacity of 151.7 MLD, 10 treatment plants are proposed with a capacity of 94.4 MLD. The existing treatment capacity of 192 MLD is merely 10.5% of the total sewage generation in the State. Even after the STPs under construction and planning are in place, the total treatment capacity would be 438.1 MLD, which is only 24% of the total sewage generated during 2010 and thus a gap of 1359.9 MLD would be there. However, the sewage will continue to grow as cities are growing and thus the gap will continue to be broadening. The gap will further increase as the sewage generation for 2020 is estimated at 2300 MLD, for 2040 at 3106 MLD and for 2060 at 3674 MLD. The cost of wastewater treatment for establishing additional sewage treatment plants using various technological options varies from Rs. 790 crores for WSP to Rs. 1796 crores for MBR as of 2010. This cost may go up to Rs. 1065 crores to Rs. 2421 crores in 2020, Rs. 1505 crores to Rs. 3421 crores in 2040 and Rs. 1815 crores to Rs. 4124 crores in 2060, respectively. This does not include cost of land and also inflation during next 50 years, which may be around 8 to 10 percent per annum. The O&M cost including electricity, chemicals, manpower and maintenance would be around 10% of the capital cost, which is again going up due to inflation.

It is also observed that due to lack of proper collection facilities in most of the cities and towns the wastewater either flows in storm water drains often unlined or accumulates in the vacant plots, low-lying areas percolates in the ground and pollute the groundwater. The wastewater, which flows in storm water drains ultimately leads to receiving water bodies and pollute them. Thus, surface and

groundwater in and around urban centers especially large urban centers is seriously affected by discharge of untreated urban wastewater. The sewage collection system in most of the urban centres is not adequate. Laying down the sewerage system will cost nearly 3 to 4 time the treatment cost. Thus, a massive investment is needed for sewage collection and sewage treatment.

The total solid wastes generation from Class-I cities is estimated at about 4179 t/d, Class-II towns at about 447 t/d, other urban centres about at 1195 t/d and rural areas at about 10300 t/d. As far as rural MSW is concerned, it is being well managed by the rural population themselves, mostly through composting and using as manure. It is the urban population, particularly the large urban centres the problem is more acute. Even smaller urban centres are reusing major part of the solid wastes through composting or other means. Thus, the focus of solid wastes management should be on larger urban centres. The municipal solid wastes can be converted to energy and manure. Various technological options for treatment of municipal solid wastes are available.

The open defecation has been a common practice in Rajasthan traditionally. Inadequate sanitation has a great economic and health impact in the State. In order to improve the situation, Govt of Rajasthan has taken an initiative to improve the sanitation by providing on-site sanitation in the State. This has significantly increased the population covered by proper sanitation facilities from merely 13% population covered in 2001 census to 67% population covered in 2011 census. However, due to lack of guidelines for operation and maintenance of septic tank there is a high risk of groundwater pollution from the septic tanks. There is a need for regulation and management of septic tanks in the State.

As mentioned above a large number of facilities are to be created to manage the urban wastes. For creating such a capacity a massive investment and a continuing commitment to future such investments are needed. Providing such funding from exchequer's money is detrimental to the economy of the State. Thus, it is important that the funding is raised from the beneficiaries following the 'Polluters pay principle'. In all the 29 Class-I cities and 26 Class-II towns sewage transport and treatment systems and municipal solid wastes management system need to be established on priority basis with adequate resources available for effective O&M of such facilities.

14.6 Assessment of Industrial Pollution

Information on industry-wise pollution load generation is generally not available; even if it is available the reliability may be questionable. Thus, the Central Pollution Control Board adopted an approach to estimate pollution contribution from industrial sources based on industrial production (CPCB 2001). In the present study also the same approach is adopted to estimate pollution load in terms of volume of wastewater and BOD load from different category of industries district-wise to get idea about which district should get priority on industrial pollution control. It is estimated that 469 MLD of industrial is generated in the State. There are four districts i.e. Bhilwara, Jaipur, Barmer and Pali together generate more than 50% of the industrial wastewater in the State. Similarly in terms of chemical loads

that are getting into the environment is highest from Udaipur followed by Chittaurgarh, Bhilwara and Kota. This is mainly due to chemical loads contributed from metallurgical industries in Udaipur and Chittaurgarh and textile dyes chemicals at Bhilwara and flyash chemicals contributed by thermal power plants in Kota. It is observed that the BOD load contribution is maximum from Alwar district followed by Jaipur; this is mainly due to presence of distilleries in Alwar and Jaipur districts. Distilleries are largest contributor of organic pollution in India and also in Rajasthan. However, most of the distilleries have adopted zero discharge and thus, most of the organic matter is reduced by this sector of industries. Thermal power contributes pollution in terms of thermal pollution if they use once-throw-cooling system. In Rajasthan Kota Super Thermal Power Plant adopted Once-throw-cooling system and thus, causing thermal pollution in Chambal River at Kota Barrage Reservoir. Similarly chemical pollution is contributed from three important sectors i.e. metallurgical industries including Zinc smelter (largest Zinc Smelter in the World), thermal power plants through metallic pollutants in the flyash. Although major parts of flyash is utilized in Rajasthan, still some part of flyash get into the air as air pollutants and deposited around thermal power plant, which ultimately pollute the water resources and thus and important contributor of chemical pollution in the State. The third category is textile industries use large amount of dyes, detergents, caustic soda and some other chemicals.

For projection of wastewater volume for future an attempt was made to use the estimated water demand for future planning stages. It is estimated that the total volume of wastewater generated from industries as of 2010 is estimated at 651 MLD, which is expected to grow to 825 MLD by 2020 and 1289 by 2040 and 2014 MLD by 2060, which is more than three times the present volume. Thus, a much larger efforts are required to control such pollution. Since, provision of treatment plants for industrial effluents is under the purview of industries themselves, being a commercial activity earning profit out of the activity, the industries have to put much larger efforts on pollution control including achieving zero discharge, reuse of entire wastewater after proper treatment and strict regulation and monitoring by pollution control boards for which much large resources inputs may be needed.

14.7 Diffuse Pollution Management

In absence of its quantification studies, which is much more cumbersome and time consuming, only fertilizers and pesticides use data district wise is presented to understand potential risk of diffuse pollution in different districts of Rajasthan. It is observed that Ganganagar and Hanumangarh districts consume highest amount of fertilizers followed by Alwar, Chittaurgarh, Kota, Bharatpur, Baran and Jaipur. Churu consumes least amount of fertilizer, as there are not much agricultural activities in this district. The per hectare total fertilizer consumption is highest in Kota, Chittaurgarh, Bundi and Baran districts. The least user was Churu district. The nitrogenous fertilizer consumption per hectare also followed the same trend. Thus, there is a high potential of fertilizer contamination in Kota, Bundi, Baran, Chittaurgarh and Banswara districts being higher consumer of fertilizers. The district-wise pesticides use data collected from Pesticides Association of India that there is a stable trend of pesticides consumption in the State. Per hectare

consumption varies from 0.27 kg/ha to 0.42 kg/ha. However, these values are far less than the national average of 0.6 kg/ha and World average of 3.0 kg/ha. It is observed that Baran district consumed highest amount of pesticides followed by Jalore district, Ganganagar and Hanumangarh districts. Churu consumes least amount of pesticides.

15. Improvement Plans

15.1 Introduction

The largest in the country, Rajasthan State covers about 10% geographical area, 5% population, 19% livestock and 14% cultivable area of the country, whereas it holds only 1.16% of the country's surface water. Its 16 river basins (considering the Outside basin) are estimated to yield about 25.38 BCM of surface water (mean availability) and another 18.74 BCM is available as State's shares in trans-boundary river waters under inter-state agreements. The irrigable land available in the state is about 15.7 million hectares requiring 75-100 BCM of water which is not there. Water availability is thus a serious constraint on food production potential of the State. Paradoxically, irrigation efficiencies of the existing projects in the state are reported to be very low varying between 5-43% of the usable water which is much below the national average.

The financial crunch in the last few decades has however resulted in ever deteriorating condition of most irrigation projects. Poor maintenance and water management have led to increasing water losses and reduction in irrigation system efficiencies as against their design norms. In order to improve the performances of irrigation projects State Government has recently rehabilitated 42 major and medium projects under the Rajasthan Water Sector Restructuring Project.

There are 114 major and medium irrigation projects (considering Bhimlat-Abheypura as one and including canal projects having imported surface water). Out of the 114 Projects, 42 major and medium projects are under rehabilitation under RWSRP and performances of these projects show that they do not require further rehabilitation. For the projects which were commissioned recently, it has been observed that there is no requirement for rehabilitation and modernization due to area is not fully developed or open for irrigation. Therefore, the remaining project for which water is stored in reservoir at regular interval and is being used for irrigation are considered as projects for rehabilitation and studied in detail. For this purpose, the consultants have developed specific methodology and tools which are discussed in following sections of the report. This aspect has been studied and presented in detail in Final Report No. 4.8.

15.2 Methodology

15.2.1 General

The main purpose of the work on irrigation projects are appraisal and economic analysis is to establish the need and justification for improvements and modifications in existing projects, to assess the costs involved and prepare the data for prioritization of the improvement plans.

The economic evaluation is based on the assessment of irrigation benefits, and the calculation of economic viability indicators of the irrigation projects, further, social indicators have also been considered in order to enable an unbiased comparison between alternative plans, and hence, prioritizing the projects on socio economic grounds.

The total 112 number projects (including canal projects having imported surface water) are appraised and project suitable for rehabilitation have been identified, the identified projects have been considered for rehabilitation and detailed appraisal of these identified projects has been carried out.

To facilitate the performance of various computations in the process of appraisal of projects, a project planning worksheet has been developed and also a Crop-Mix Linear Programming model has been developed which aims at finding the crop mix which maximizes farm net income under varying constraints on irrigation water availability.

The computational model analyzes the relation between varying irrigation water supply conditions in the project, in monthly units, and the agricultural production, thus simulating the response of the farmers to irrigation water supply conditions. By changing the water supply conditions by improving the performance of existing projects and computing the resulting changes in agricultural production and farm income, it is possible to assess the economic viability of improvement plans.

15.2.2 Project Planning Sheet

To facilitate the performance of various computations in the process of appraising projects and formulating a plan for improvements, a project planning worksheet has been devised as an Excel electronic spreadsheet. This computational aid was also designed to be linked with the crop-mix linear programming (CMLP) model described below. All the input data, and the results related to the economic analysis performed with these data, must be given for two scenarios - with and without the plan being considered with respect to improvement and modifications in existing projects. All the time-related input data and results are in annual terms, unless otherwise indicated, specified for four Planning Stages: present (2010), year 2020, year 2040 and year 2060.

15.2.3 CMLP Model

A simplified linear programming (LP) procedure has been developed by the Consultant for selecting the crop mixes that would give the highest benefits from individual projects, given the project's constraints on availability of water and land. The program includes crop production, income and cost data representing different regions, agro-climatic conditions and climatic states, as well as the amount of cultivable command area (CCA) and water availability conditions in the analyzed project. Calculation of the net benefits is dependent on the salient features of the projects. The crop-mix linear programming model (CMLP) aims at finding the crop mix which maximizes farm net income under varying constraints on irrigation water availability. The main components of the model are:

- Water supply and demand:
  water supply
  - surface water from reservoirs
  - surface water by pumping from the run of the river (lift irrigation)
  - ground water

  water demand by crops

- Land supply and demand and crop constraints
  - available irrigable land
  - land occupancy by crops
  - special constraints on crop areas
- Cost of water and income:
  - cost of water
    - cost per m^3
    - cost per ha
  - farm income
  - total net income.

The response of the farming community to various water availability conditions involves decision making under uncertainty with regard to climatic conditions. To analyze the response of farmers to irrigation water conditions under uncertainty, it is assumed that the climatic probability distribution is represented by four climatic states, or dependabilities, each assigned a probability of occurrence. The four climatic states are denoted in the computational model by State1, State2, State3 and State4, corresponding to dependabilities of 90%, 75%, 50% and 25%. It is further assumed that, based on past experience, the probabilities, or weights, of the climatic states are known, and the objective is to maximize the mean, or weighted average, of farm incomes. Accordingly, the model includes four sets of water supply conditions, corresponding to the four climatic states with their four probabilities, or weights. The main variables to be determined by the model are four sets of cropped areas, corresponding to the four irrigation water conditions related to the four climatic states.

There are two main cropping seasons, namely Rabi and Kharif. For the Rabi season, at the time of deciding on crop sowing most of the rain has already fallen, the amount of water available for irrigation from the project's storage reservoir is known in advance, and the decision on Rabi crops is a decision under certainty. Only small amounts of rain are expected during the growing season itself, and for practical purposes the water requirement of the sown Rabi crops does not depend on the rainfall during the season.

On the other hand, both the supply and the demand for irrigation water for Kharif crops depend on the climatic conditions during the cropping season. The degree of certainty existing at the time of decision making on the Kharif crops, with respect to the water supply conditions, depends on the type of water source. Depending on the degree of certainty, in some cases there would be only one set of selected Kharif crop areas common to all four climatic states, while in other cases there would be four sets. This follows from the approach adopted with regard to uncertainty as discussed in the next paragraph.

As the decision on Rabi crops is made under conditions of certainty, and since it is of interest on its own, a special application of the model was formulated for this purpose, which can be viewed as a sub-model of the more general LP model. It is different from the general model in that it contains only one set of known water supply conditions and one set of crop area variables.

15.2.4 Crops' Income Per Hectare Projections

A significant importance was given to the net farm income derived from the additional agricultural activity. In order to assess the expected benefits due to an improved agricultural project, a net income per hectare projection was conducted to each of the agro-climatic zone and for each of the crop which was included in the ACZ's cropping pattern.

The projected net income per hectare is fully dependent on the expected yield of the various crops in each ACZ, the costs of cultivation and the future farm gate prices in each of the future time points (present time 2010, 2020, 2040, 2060). A long term farm gate prices projection is affected by numerous variables that make it somewhat uncertain to predict, and in order to overcome this uncertainty, the long term median prices were used to reflect the mean expected future farm gate prices.

The methodology used was to adjust the current published prices with the index of farm harvest prices (all crops), excluding abnormal observations. The assumption is that occurrences of events influencing farm harvest prices recur on a certain cycle; hence a long term median price already reflects such recurrences.

After analysing the projected crop harvest prices and multiplying the total expected yield in each of the four time points (present day, 2020, 2040, 2060) with the median expected price, the ACZ's costs of cultivation were subtracted from the total income, hence presenting the expected net total income per hectare.

15.2.5 Unit Cost Analysis for Rehabilitation Works

A unit cost basis is developed by the Consultant for the purpose of estimating the investments and operational costs of the improvement plans and is implemented within the economic analysis and prioritization.

As a basis for estimating the cost of rehabilitation and modernization works required in existing irrigation projects, the Consultant have analyzed the proposals which were formulated by the irrigation department in the framework of the (RWSRP) Rajasthan Water Sector Restructuring Project. This analysis provides a set of unit costs per hectare of irrigation canal system and unit costs per m^3 for rehabilitation and modernization of dam (head work).

Unit costs for the construction of wells, feeder canals, etc., and the costs of pumping equipment and pumping energy, have also been estimated, both for capital and O&M costs and for groundwater utilization and surface water lifting.

15.3 Appraisal of the Identified Project for Rehabilitation

15.3.1 General

Project appraisals were carried out for identified Major and Medium projects. The general review covered the following aspects:

(i) Availability of surface water.
(ii) Adequacy of the existing storage capacity.
(iii) Adequacy of existing CCA.

As a result, suggestions were made for changes such as: increasing the storage capacity if possible, if additional surface water was found to be available; expanding (or reducing) the CCA; introducing changes in the main canal system and other changes in existing projects.

15.3.2 Surface Water Availability

Surface water availability for the identified projects was calculated using SWAT Model at 25%, 50%, 75% and 90% climatic dependability levels.

Net availability of surface water for irrigation was computed by taking into account siltation of dams, seepage and evaporation losses, and deducting the projected amounts of water required to be supplied from the project's reservoir for domestic and industrial consumption. The availability of irrigation water on-farm was calculated on the basis of assumed conveyance efficiency values.

15.3.3 Groundwater Availability

In addition to surface water, groundwater availability (natural replenishment) within the command area of every irrigation project was also assessed, as well as the amounts of return flow from irrigation and domestic water utilization, and these amounts were also taken into account as available for irrigation, after allowing for domestic, livestock and other groundwater requirement within the gross command area (GCA). In irrigation projects overlying highly saline aquifers, groundwater was not considered as utilizable for irrigation.

Thus, conjunctive use of surface and ground water was considered in all the projects as a basis for the economic analysis of project improvement plans. However, a distinction was made between groundwater in projects located above alluvial aquifers, and others, considering that in the first case more aquifer storage is available for compensating the lack of surface water in lean years. In such a case of course the combined surface and groundwater supply to irrigation is more reliable than in the case of relatively small aquifer storage, and even more so compared to surface water supply alone.

In addition to the obvious advantages of conjunctive use of surface and ground water, the Consultants consider groundwater withdrawal within surface water irrigation projects also as a necessity, to counter the danger of water logging due to irrigation return flows. This danger is most acute in areas where at present groundwater levels are high and rising, but should be taken into consideration for long term planning in any irrigation project.

For the purpose of analyzing the economic feasibility of introducing improvement in existing irrigation system the consultant have reviewed the results of already rehabilitated project under RWSRP and conservatively assumed that the following efficiencies can be attained.

1. Off farm conveyance efficiencies in existing projects after improvement are 72% for selective lining and 75% for complete lining.
2. On farm efficiency is set on 70%. The percolation losses and evaporation losses are 25% and 5% respectively.

The projects selected for detailed appraisal are listed in Table 15.1. The location of these projects is shown in Map of Improvement Plans given at the end of this report.

Table 15.1: Projects Selected for Detailed Appraisal for Rehabilitation

S. No.	Basin	S. No.	Project
1	Shekhawati Basin		Nil
2	Ruparail Basin		Nil
3	Banganga Basin	1	Madho Sagar
4	Gambhir Basin		Nil
5	Parbati Basin		Nil
6	Sabi Basin		Nil
7	Banas Basin	2	Arwar
		3	Badgaon
		4	Bagolia
		5	Bassi
		6	Bhopal Sagar
		7	Chandra Bhaga
		8	Chandsen
		9	Chhaparwara
		10	Dheel
		11	Dindoli
		12	Kalisil
		13	Khari
		14	Kothari
		15	Lassaria
		16	Mataji Ka Khera
		17	Meja
		18	Murlia
		19	Narain Sagar Jalia
		20	Rajsamand
		21	Sareri
		22	Tordi Sagar
		23	Udai Sagar
		24	Ummed Sagar
		25	Vallabh Nagar
		26	Wagan
8	Chambal Basin	27	Billas
		28	Dugari
		29	Galwania
		30	Gopalpura
9	Mahi Basin	31	Jaisamand
		32	Jakham
		33	Mahi
		34	Somkagdar
10	Sabarmati Basin		Nil

S. No.	Basin	S. No.	Project
11	Luni Basin	35	Sardarsamand
12	West Banas		Nil
13	Sukli Basin		Nil
14	Other Nallah		Nil
15	Ghaggar Basin		Nil
16	Out Side Basin		Nil

15.4 Outcome of Economic Analysis

The economic indicators calculated according to the CMLP results are performed according to the projects features as follows:

(i) Project's benefit cost ratio.
(ii) Total project cost per unit of water supply.
(iii) Present value of total project cost per hectare (of CCA).

The economic indicators calculated according to the CMLP results are given in Table 15.2 below.

Table 15.2: Economic indicators for existing irrigation projects

S. No.	Project Name	Class	Benefit/Cost		Cost of Water		CCA		PV of Investments (per ha)	
			Ratio	Rank	Rs./m^3	Rank	ha	Rank	Rs.	Rank
	Set weights "A": Economic benefit approach		2		2		1		2	
	Set weights "B": Social approach		1		1		1		1	
	Improvements in Existing Projects		Value	Rank	Value	Rank	Value	Rank	Value	Rank
1	Arwar	Medium	2.38	11	0.66	16	7,394	11	7,591	18
2	Badgaon	Medium	0.95	26	1.52	31	6,797	12	7,056	14
3	Bagolia	Medium	0.29	35	5.44	35	3,676	23	7,691	24
4	Bassi	Medium	3.86	1	0.40	5	3,250	26	6,202	4
5	Bhupal sagar	Medium	0.93	27	1.32	29	3,873	22	9,310	26
6	Bilas	Medium	2.34	12	0.38	4	5,863	16	5,725	3
7	Chandrabhaga	Medium	1.65	19	1.29	28	3,342	25	7,691	21
8	Chandsain	Medium	1.93	17	0.85	19	2,600	30	11,646	35
9	Chaparwada	Major	0.78	32	1.54	32	11,745	6	9,793	30
10	Dheel	Medium	1.25	22	1.00	25	5,943	15	9,950	31
11	Dindoli	Medium	2.96	6	0.64	15	2,056	34	7,146	16
12	Dugari	Medium	2.16	13	0.59	13	2,251	32	7,691	20
13	Galwania	Medium	3.64	2	0.53	12	2,257	31	8,289	25
14	Gopalpura	Medium	0.50	34	0.28	1	3,557	24	6,652	10
15	Jaisamand	Major	1.23	23	0.40	7	16,000	4	11,484	34
16	Jakham	Major	2.94	7	0.36	2	28,308	2	5,452	1
17	Kalisil	Medium	1.21	24	0.44	8	4,700	18	7,691	22
18	Khari	Medium	2.70	9	0.70	18	6,478	13	7,591	17
19	Kothari	Medium	2.73	8	0.46	9	4,395	20	6,202	5

S. No.	Project Name	Class	Benefit/Cost		Cost of Water		CCA		PV of Investments (per ha)	
			Ratio	Rank	Rs./m^3	Rank	ha	Rank	Rs.	Rank
20	Lassadia	Medium	3.27	4	0.48	10	2,080	33	6,652	9
21	Madhosagar	Medium	1.78	18	0.88	21	3,232	27	11,398	32
22	Mahi Bajaj	Major	2.14	15	0.40	6	80,000	1	9,464	27
23	Mataji Ka Khera	Medium	3.13	5	0.86	20	3,057	28	7,691	19
24	Meja	Major	1.53	20	1.07	26	20,714	3	6,693	12
25	Murlia	Medium	3.44	3	0.38	3	1,323	35	7,146	15
26	Narain Sagar Jalia	Medium	0.82	31	2.39	34	4,087	21	7,691	23
27	Rajsamand	Major	2.14	14	0.98	24	10,450	7	6,693	11
28	Sardar Samand	Major	1.95	16	0.91	22	10,325	8	6,448	6
29	Sareri	Medium	0.93	28	0.95	23	9,717	9	5,508	2
30	Somkagdar	Medium	0.88	29	0.49	11	5,739	17	6,569	8
31	Tordi Sagar	Major	0.87	30	1.50	30	13,960	5	9,793	29
32	Udai Sagar	Medium	0.73	33	1.22	27	4,650	19	11,411	33
33	Ummed Sagar	Medium	1.51	21	0.67	17	2,968	29	9,690	28
34	Vallabhnagar	Medium	1.08	25	1.85	33	6,464	14	7,056	13
35	Wagan	Medium	2.67	10	0.60	14	8,270	10	6,569	7

15.5 Project's Prioritization

Long-term decisions by the Government of Rajasthan on investing in irrigation projects should be based on priority considerations, as well as budget and implementation capacity constraints. These considerations can be based on quantifiable as well as non-quantifiable attributes of the projects under consideration, and various persons or authorities, in considering their preferences, may assign different weights to the various attributes of the proposed projects.

The Consultants have developed a computational tool for multi-objective prioritization of projects, intended to enable ranking irrigation projects in an order of priorities according to a number of economic and other factors, or attributes, and according to different weights which can be assigned to these factors.

15.5.1 Prioritization Factors

Prioritization is influenced by a number of quantifiable factors which determine the relative ranking of each factor (or attribute) in comparison to the rest of the irrigation projects.

These attributes that are taken into consideration within the prioritization model include economic, engineering and social consideration, which are calculated (or attributed) to each project separately according to the project's features.

The factors which affect the ranking include:

(i) Benefit-Cost (B/C) ratio.
rank number 1 = highest B/C ratio;

(ii) The cost of m^3 of water (total costs of supply).
rank number 1 = lowest cost of water;

(iii) Size of the cultivable command area (CCA).

rank number 1 = highest value;

(iv) Present value of the total investments per hectare.
rank number 1 = lowest PV

(v) Present value of added water supply for priority sectors.
rank number 1 = highest percentage

(vi) Size of submergence area.
rank number 1 = lowest submergence

(vii) Age (years since the initial year of the project's commissioning).
rank number 1 = oldest project

(viii) Supply to disadvantaged social sectors, such as Scheduled Tribes (ST) and Scheduled Castes (SC).
rank number 0 = yes, if there is such a supply component in this project; otherwise = 1.

(ix) Supply to drought-prone areas (DPA).
rank number 0 = yes, if this is a DPA; otherwise = 1.

The rank order numbers of every quantifiable attribute within each of the project categories is given in order to indicate the place of the numerical value of that attribute in the list of projects when this list is arranged in a descending or ascending order of the values of the attribute concerned (depending on the nature of the attribute), as described above.

Ultimately, the model generates a final priority list of projects according to the sum of the rank numbers multiplied by the weights assigned to the various attributes, which leads to the level of weights attribution to the prioritizing factors.

15.5.2 Weights attribution to prioritizing factors

In the prioritizing process a set of weights is attributed to the various prioritizing factors. The weights indicate the degree of importance each factor receives. While attributing weights there is a set of subjective considerations that affect the prioritization, which reflect the policy by which the prioritization is conducted. A different set of weights will determine a different ranking order of the projects. The prioritization hereby is determined according to two sets of weights, which reflect different considerations while ranking the projects. The two sets of weights reflect two policies or approaches, as described below:

(i) Economic benefit approach:

The set of weights gives greater weight (a value of "2") to the economic viability indicators: benefit-cost ratio, cost of water and PV of investments in the CCA. The other prioritizing factors receive a lower weight (a value of "1").

(ii) Social approach:

The set of weights gives a greater weight (a value of "2") to the social factors: PV of added supply for priority sectors, supply to disadvantaged social sectors and

supply to drought-prone areas. The other prioritizing factors receive a lower weight (a value of "1").

Table 15.3: Sets of weights attribution to prioritizing factors

Prioritizing Factor	Benefit /Cost	Cost of Water	CCA	PV of Investments per ha	PV of added supply for Priority Sectors	Submergence Area	Age	ST, SC 1=No 0=Yes	DPA 1=No 0=Yes
Set weights "A": Economic benefit approach	2	2	1	2	1	1	1	1	1
Set weights "B": Social approach	1	1	1	1	2	1	1	2	2

Table 15.4 shows the rank number by attributes for the various projects analysed.

15.5.3 Prioritization

The model generates a final priority list of projects according to the sum of the rank numbers multiplied by the weights assigned to the various attributes and factors as shown in Table 15.5.

Table 15.4: Rank Numbers by Attributes Project Wise

S. No.	Project		Benefit/Cost		Cost of Water		CCA		PV of Investments per ha)		PV of added supply for Priority Sectors		Submergence Area		Age		ST, SC 1=No 0=Yes	DPA 1=No 0=Yes
	Name	Class	Ratio	Rank	Rs./m^3	Rank	ha	Rank	Rs.	Rank	m^3	Rank	km^2	Rank	Years	Rank		
	Set weights "A": Economic benefit approach		2		2		1		2		1		1		1		1	1
	Set weights "B": Social approach		1		1		1		1		2		1		1		2	2
	A. Improvements in Existing Projects		Value	Rank	Value	Rank	Value	Rank	Value	Rank	Value	Rank	Value	Rank	Value	Rank	Value	Value
1	Arwar	Medium	2.38	11	0.66	16	7,394	11	7,591	18	0	1	0	1	53	14	0	1
2	Badgaon	Medium	0.95	26	1.52	31	6,797	12	7,056	14	0	1	0	1	44	23	0	1
3	Bagolia	Medium	0.29	35	5.44	35	3,676	23	7,691	24	0	1	0	1	54	12	0	1
4	Bassi	Medium	3.86	1	0.40	5	3,250	26	6,202	4	0	1	0	1	24	32	0	1
5	Bhupal sagar	Medium	0.93	27	1.32	29	3,873	22	9,310	26	0	1	0	1	74	9	0	1
6	Bilas	Medium	2.34	12	0.38	4	5,863	16	5,725	3	0	1	0	1	15	35	0	1
7	Chandrabhaga	Medium	1.65	19	1.29	28	3,342	25	7,691	21	0	1	0	1	53	14	0	1
8	Chandsain	Medium	1.93	17	0.85	19	2,600	30	11,646	35	0	1	0	1	130	2	0	1
9	Chaparwada	Major	0.78	32	1.54	32	11,745	6	9,793	30	0	1	0	1	116	5	0	0
10	Dheel	Medium	1.25	22	1.00	25	5,943	15	9,950	31	0	1	0	1	99	7	0	1
11	Dindoli	Medium	2.96	6	0.64	15	2,056	34	7,146	16	0	1	0	1	45	22	0	1
12	Dugari	Medium	2.16	13	0.59	13	2,251	32	7,691	20	0	1	0	1	55	11	0	1
13	Galwania	Medium	3.64	2	0.53	12	2,257	31	8,289	25	0	1	0	1	56	10	0	1
14	Gopalpura	Medium	0.50	34	0.28	1	3,557	24	6,652	10	0	1	0	1	30	27	0	1
15	Jaisamand	Major	1.23	23	0.40	7	16,000	4	11,484	34	0	1	0	1	280	1	0	1
16	Jakham	Major	2.94	7	0.36	2	28,308	2	5,452	1	0	1	0	1	24	32	0	1
17	Kalisil	Medium	1.21	24	0.44	8	4,700	18	7,691	22	0	1	0	1	54	12	0	1
18	Khari	Medium	2.70	9	0.70	18	6,478	13	7,591	17	0	1	0	1	53	14	0	1
19	Kothari	Medium	2.73	8	0.46	9	4,395	20	6,202	5	0	1	0	1	21	34	0	1
20	Lassadia	Medium	3.27	4	0.48	10	2,080	33	6,652	9	0	1	0	1	30	27	0	1
21	Madhosagar	Medium	1.78	18	0.88	21	3,232	27	11,398	32	0	1	0	1	123	3	0	1
22	Mahi Bajaj	Major	2.14	15	0.40	6	80,000	1	9,464	27	0	1	0	1	27	30	0	1
23	Mataji Ka Khera	Medium	3.13	5	0.86	20	3,057	28	7,691	19	0	1	0	1	52	19	0	1
24	Meja	Major	1.53	20	1.07	26	20,714	3	6,693	12	0	1	0	1	53	14	0	1

S. No.	Project		Benefit/Cost		Cost of Water		CCA		PV of Investments per ha)		PV of added supply for Priority Sectors		Submergence Area		Age		ST, SC 1=No 0=Yes	DPA 1=No 0=Yes
	Name	Class	Ratio	Rank	Rs./m^3	Rank	ha	Rank	Rs.	Rank	m^3	Rank	km^2	Rank	Years	Rank		
25	Murlia	Medium	3.44	3	0.38	3	1,323	35	7,146	15	0	1	0	1	43	25	0	1
26	Narain Sagar Jalia	Medium	0.82	31	2.39	34	4,087	21	7,691	23	0	1	0	1	43	25	0	1
27	Rajsamand	Major	2.14	14	0.98	24	10,450	7	6,693	11	0	1	0	1	47	20	0	1
28	Sardar Samand	Major	1.95	16	0.91	22	10,325	8	6,448	6	0	1	0	1	106	6	0	0
29	Sareri	Medium	0.93	28	0.95	23	9,717	9	5,508	2	0	1	0	1	53	14	0	1
30	Somkagdar	Medium	0.88	29	0.49	11	5,739	17	6,569	8	0	1	0	1	27	30	0	1
31	Tordi Sagar	Major	0.87	30	1.50	30	13,960	5	9,793	29	0	1	0	1	122	4	0	1
32	Udai Sagar	Medium	0.73	33	1.22	27	4,650	19	11,411	33	0	1	0	1	46	21	0	1
33	Ummed Sagar	Medium	1.51	21	0.67	17	2,968	29	9,690	28	0	1	0	1	93	8	0	1
34	Vallabhnagar	Medium	1.08	25	1.85	33	6,464	14	7,056	13	0	1	0	1	44	23	0	1
35	Wagan	Medium	2.67	10	0.60	14	8,270	10	6,569	7	0	1	0	1	28	29	0	1

Table 15.5: Final ranking of project by two weights attribution approaches

Project	Ranking Approach A			Ranking Approach B		
	Priority-Summary A value	Rank A	Value / Average	Priority-Summary B value	Rank B	Value / Average
Arwar	118	10	80.6%	75	6	79.4%
Badgaon	180	27	122.9%	111	29	117.5%
Bagolia	226	34	154.3%	134	33	141.9%
Bassi	81	2	55.3%	73	3	77.3%
Bhupal sagar	198	31	135.2%	118	32	125.0%
Bilas	92	3	62.8%	75	7	79.4%
Chandrabhaga	178	26	121.5%	112	30	118.6%
Chandsain	177	25	120.8%	108	26	114.4%
Chaparwada	201	32	137.2%	108	28	114.4%
Dheel	181	28	123.6%	105	24	111.2%
Dindoli	133	15	90.8%	98	20	103.8%
Dugari	138	19	94.2%	94	18	99.5%
Galwania	122	11	83.3%	85	14	90.0%
Gopalpura	144	21	98.3%	101	22	107.0%
Jaisamand	136	17	92.8%	74	4	78.4%
Jakham	57	1	38.9%	49	1	51.9%
Kalisil	141	20	96.3%	89	17	94.3%
Khari	118	9	80.6%	76	8	80.5%
Kothari	101	4	68.9%	81	10	85.8%
Lassadia	109	8	74.4%	88	16	93.2%
Madhosagar	175	24	119.5%	106	25	112.3%
Mahi Bajaj	130	13	88.7%	84	13	89.0%
Mataji Ka Khera	138	18	94.2%	96	19	101.7%
Meja	136	16	92.8%	80	9	84.7%
Murlia	105	7	71.7%	86	15	91.1%
Narain Sagar Jalia	225	33	153.6%	139	35	147.2%
Rajsamand	128	12	87.4%	81	11	85.8%
Sardar Samand	104	6	71.0%	61	2	64.6%
Sareri	132	14	90.1%	81	12	85.8%
Somkagdar	146	22	99.7%	100	21	105.9%
Tordi Sager	190	30	129.7%	103	23	109.1%
Udai Sagar	229	35	156.3%	138	34	146.1%
Ummed Sagar	172	23	117.4%	108	27	114.4%
Vallabhnagar	182	29	124.2%	113	31	119.7%
Wagan	104	5	71.0%	75	5	79.4%
Average	**146.5**			**94.4**		

16. Development Plans

16.1 Introduction

Following the assessment of water resources available in the given study units and the projected water demand for the concerned consumer sectors it was possible to proceed with the work aimed to identify the areas of surplus water and identify projects to utilize this surplus water within Rajasthan. Appreciation of this subject matter should be considerate with the natural and man-made situation of the state, which may be summarised as follows:

- Rajasthan state is land-locked, divided in two distinct areas by Aravalli mountain range. The western side of the state is dry, sparsely populated (at least compared with the other side of the Range), drains westward to the Arabian Sea and to large extent relies on imported surface water brought by Indira Gandhi Canal. The eastern side is more humid, drains east-northerly to the Ganga Basin, much more populated and accommodates the majority of water-related activities such as domestic supply, irrigation and industries.
- To a large extent, the State covers the head-race of river basins and endeavours to utilise the basins' generated surface water largely by capturing surface water flows in reservoirs (mostly seasonal) and exploiting it for irrigation. Nevertheless, downstream of these reservoirs, there is still a catchment area – within the State's boundaries – that merit study for utilization for irrigation and/or groundwater recharge.
- Reliance on imported water is problematic, to a large extent because Rajasthan lies at lower reach of the conveyance systems. In times of adverse climatic conditions (the time when the reliance is mostly felt), upper users, which also face scarcity, restrict outflows.
- Demand for fresh water, particularly for domestic (and also industrial) use is rapidly increasing, putting pressure on the agricultural sector that has to oblige for the decrease in water availability by raised water use efficiency.
- At the same time, groundwater is excessively exploited by indiscriminate uncontrolled abstraction for domestic as well as for irrigation, considerably beyond the naturally dependable ('safe') recharge capacity; it is clearly evident in the progressing trend of depleting water tables.
- Modern economic activities, expressed in urbanization, developing industries and increased use of agrochemicals, produce ever increasing pollutants that endanger water quality, which, if not taken care of, might deteriorate to causing redundancy of use in some cases.
- At present, fresh water is the resource in use. With the foreseeable depletion of it (either due to increased demand and/or due to water quality deterioration) segregation of use would be in need.

Given the above-mentioned observations, the Consultants have broadened the meaning of the terms 'new projects' and 'surplus basins' to encompass not only surpluses derived from the balance between water demand and availability in a river basin, but also the possible utilization of untapped water resources at large, including their quality aspects. The main consequence of this approach is that there may be several new projects, which may constitute measures and activities related

to address water surpluses, on one hand, and avoid quality-wise redundancy perils on the other hand.

16.2 Approach and Methodology

16.2.1 Planning Guidelines

Rajasthan State Water Policy (SWP) states that for water resources management and planning purposes the order of priorities of water allocation will be as follows (in highest to lowest order):

- Human drinking water;
- Livestock drinking water;
- Other domestic, commercial and municipal water uses;
- Agriculture;
- Power generation;
- Environmental and ecological;
- Industrial;
- Non-consumptive uses such as cultural, leisure and tourist uses;
- Others.

The SWP also states that any departure from the above priorities will require consideration on a case-by-case basis.

This Study has employed the following approach to achieve its objectives:

- Recognition of the relevant water sources available in the basin/sub-basin/micro watersheds, including locally generated and imported surface water and groundwater sources.
- Recognition of the concerned water consumers in the study area, categorised by sector; that include the following:
  - Non-agricultural sectors, subdivided as follows:
    - Domestic; urban centres identified by name, while rural consumers spread over the basin/sub-basin/micro watershed area without indication of specific location.
    - Livestock, spread over the basin/sub-basin/micro watershed.
    - Industries; location of contiguous industrial areas and/or isolated but major industries to be identified by demand and location.
    - Cooling water for power plants, to be identified by demand and location.
    - Ecology related water requirements (for game reserves, wildlife sanctuaries, etc.) to be associated with forest areas.
  - Irrigated agricultural sector, expressed in terms of existing major and medium irrigation projects identified by name and specific features, and minor projects, lumped in clusters assigned with totals of the relevant features.
- Carry out applied water supply and demand balance for the study area. The State Water Policy has been assigned as required, including, as applicable, reservation of surface water for designated priority consumers with due attention paid to their spatial configuration. The policy of conjunctive use of water has been followed. Such balances are oriented to determine surplus water

in different reaches of the basin/sub-basin/micro watersheds in developed areas.

- Identified surplus water obtained from basins/sub-basins/micro watersheds showing water in excess of the current and future needs has been studied for identifying new projects for implementation, based on preliminary cost estimates and economic analysis, aimed for future development, with particular attention to the higher priority of drinking water supplies and possible need to provide for future reserve allocations for this sector.
- Study the areas downstream of already developed water projects to identify unutilized surface water resources.
- Conceptualise new projects based on water balance assessments and surplus water study, using scientific study and based on socio economic viability criteria, such as:
  - Sustainability of the environment and ecological habitat.
  - Micro watershed based approach for taking up new projects has been followed to ensure equity.
- On basis of case-by-case study, envisaged new projects may include,
  - Construction of surface water storage projects. In such cases, inter-state agreements, if any, has been considered for minimum release at the state boundary.
  - Inter-basin water transfer projects.
  - Enhancement of water harvesting, particularly for artificial groundwater recharge in different reaches of the basin/sub-basin to harness locally-generated runoff flows for probable groundwater recharge.
- Proposals for new projects in water surplus basins are based on project design reports as available, desk-top studies and basic data on water availability.

16.2.2 General Approach

16.2.2.1 Water Resource Categories

In line with the overview observation, the State's water resources are categorized in the following terms:

- SW: Surface water (stream flows) generated from within Rajasthan boundaries;
- ISW: Imported water delivered to Rajasthan from other states by means of several projects under relevant inter-state agreements;
- GW: Groundwater, in terms of Dynamic availability, considered to represent the sustainable quantities of this category.

Quantity-wise and spatially the ISW resources are well determined in the relevant inter-state agreements and are considered in this Study context as being practically fully utilised where applicable. With similar aspect and as discussed in other reports of this Study, the State's GW resources are already over-exploited to the extent that, indeed need recovery measures. Thus, looking for under-utilization – or otherwise determined as 'surplus' water resources is practically related with the SW category of the State's water resources.

16.2.2.2 Expected Localities

Historically, exploitation of the State's water resources was oriented by optimal combination of optimal integration of catchment area, adequate storage site and proper soils and topography for agricultural development. This practice has led to the current state of most of the water resources development projects being located in upper to mid reaches of river basins\sub-basins and resulted in many cases an observable situation of a development demarcation delineating basins\sub-basins in 'substantially developed' upstream portion and 'poorly-developed' downstream portion. Subsequently, further water harvesting took place mostly in the upstream, substantially-developed, catchments, further accentuating this state with more expectation accentuated towards the downstream reaches of basins\sub-basins.

16.2.2.3 Study Level

Basin, Sub-basin and Micro watershed wise utilization levels have been assessed in the subsequent Sections with a major intention of reaching at a preliminary 'identification' stage of surplus water. The methodology applied and described below is apt for this purpose and produces the desired outcome.

16.2.3 Methodology for Search of Surplus Water

16.2.3.1 Water Availability

Water availability rises from precipitation, being a stochastic event. Accordingly, studies for water resources should be founded on sufficient number of occurrences, presented in terms of series that provide a sound basis for statistical analysis. To this end, this Study relies on simulated series of the project-standard 38 years period of 1973 through 2010 (inclusive).

Detailed Study on Catchment Areas assessed what has been termed as 'intervened' flow series (of the same standard period of 1973 to 2010) at all Major and Medium dams, taking into account Minor dams and Water Harvesting Structures (WHSs) that exist in the catchment area of the relevant Major / Medium dams.

The fundamental series used for the areas downstream of any Major/Medium project refer to the said period simulated natural ('virgin') flows at the relevant basin/ sub-basin/ micro watershed generated using SWAT model.

16.2.3.2 Assessment of 'Free Remaining Area' Water Surplus

The current spread of the existing water utilization projects is conceptualised as follows:

- The strongest relevancy of water resources is reflected in geographic configuration, expressed in terms of Basins, Sub-basins and further down by Micro watersheds (MWSs).
- The status of geographic units configure existing upper-reach areas of existing Major/Medium projects. The conceptualised downstream catchment border of these projects is termed as 'Free Remaining Area' (FRA).

- While practically in all areas upstream of the existing Major/Medium projects the use of water has already reached full utilization (if not already largely surpassed) of water potential, the area downstream of the existing Major/Medium projects, termed as 'Free Remaining Area' may present potential of still not fully utilised ('under-utilised') water resources.

Cases might be as follows:

- **There is (or are) existing Major/Medium Project(s) in the studied basin\sub-basin.** In this case, the individual micro watersheds falling in 'Free Remaining Area' i.e. downstream of Major/Medium Project(s) have been studied as per the methodology presented below and in addition spills from upstream Major/Medium Project(s) as per WEAP simulation results have been considered.
- **There is no existing Major/Medium Project in the studied basin\sub-basin.** In this case, all the area acts as 'Free Remaining Area' and all the individual micro watersheds have been studied as per the methodology presented below.

16.2.3.3 Assessment Procedure

The adopted methodology for micro watershed wise search of under-utilised / surplus water potential in the 'Free Remaining Area' is as follows:

Step 1

The nature of existing water catchment projects is seasonal in the sense that flows arrive during the monsoon period and are stored in the project reservoir ("dam"); the stored water is then released for use in irrigation and\or other purposes (domestic \ industrial demand). Since the common practice is that the provided storage capacity is aimed for 75% dependability, unavoidable spills occur in rainy years.

Expectedly, siltation occurs in the existing reservoirs and reduces their storage capacity projected for the planning stage years of 2010, 2020, 2040 and 2060. These have been calculated after deducting the amount of silt accumulated in the reservoirs from the year of construction of the projects as follows:

$$S = s*Ac*T/1,000,000$$

where:

S = Total accumulated silt, Mm^3;

S = Siltation rate, in terms of $m^3/km^2/yr$, as applicable for each basin;

Ac = Catchment area, in km^2;

T = Time, in years, from construction to the projected year.

To calculate the nominal irrigation rate for the relevant micro watershed, the weighted average of the crop water requirements at 75% dependability of the districts in which the irrigation project falls have been taken. The relevant total efficiency for delivery and application of irrigation has been adopted to produce the corresponding gross irrigation rate, in mm.

Step 2

Based on the catchment areas, determine the flow series for assessment of the water potential of the intervened (intercepted) and un-intercepted area in the micro watershed. The following procedure has been applied:

[BFS] (Base Flow Series): The simulated virgin flow series derived for the relevant micro watershed (in Mm^3).

[IFS] (Intervened Flow Series): The intervened flow series related with the cluster of the minor projects and WHSs existing in the relevant micro watershed calculated on area proportion basis, considering the total area of micro watershed and the area intercepted by minor projects and WHSs (in Mm^3).

[UIFS] (Un-intercepted Flow Series): The un-intercepted flow series, obtained as follows (in Mm^3):

[UIFS] = [BFS] – [IFS], this series gives the surplus water from the un-intercepted area of the relevant micro watershed (in Mm^3)

Step 3

Affect a provisional micro watershed wise operation process on the intervened flow series, applying the following nomenclature. The provisional operation has been performed (repeated) applying the relevant conditions projected for the prescribed Planning Stages of 2010, 2020, 2040 and 2060, as follows:

Data

[0]: Total (lumped) storage capacity (in Mm^3) of the Minor projects (as arrived at after considering siltation) in intervened catchment of micro watershed taken from the relevant Projects table (salient features).

[L]: Expected reservoir water losses (in %).

[1]: Total effective storage (in Mm^3) of Minor projects, obtained after applying losses.

[2]: Storage (in Mm^3) reserved for domestic\industrial demand.

[3]: Total storage (in Mm^3) remaining for irrigation, obtained by

= [1] – [2].

[4]: Gross water application rate for irrigation (in mm), obtained by

= Net irrigation rate / Total (delivery and application) efficiency.

Operation, performed on the annual flows along the intervened series

[5]: Actual Water Stored in the Minor Projects (in Mm^3), obtained by

= IF [IFS] exceeds [0], then [0], else [IFS].

[6]: Outfall ('Spill') (in Mm^3), obtained by

= IF '[IFS] exceeds [0] + WHS, then [IFS] – [0] – WHS capacity, else zero

where

WHS = lumped storage capacity (in Mm^3) of the Water Harvesting Structures existing in the relevant micro watershed

[7]: Actual available water for irrigation (in Mm^3), considering that water stored in dead storage cannot be used for irrigation

[8]: Area irrigated with actual available water for irrigation (in ha), obtained by

= ([7]*10^5 / [4]), restricted to CCA

[9]: Percent of CCA irrigated with the actual available water for irrigation, obtained by

= ([8]*100 / Total CCA).

Step 4

The intervened flow series and the series of projected (for 2010, 2020, 2040 and 2060 planning stages) provisional operations have been statistically analysed to obtain, in addition to mean values, also the prescribed dependability levels of 25%, 50% 75% and 90%.

Step 5

Flows from the un-intercepted area of the micro watershed and spills from the intervened area of the micro watershed, when added together gives the total surplus water from the micro watershed.

Step6

The links between the micro watersheds have been studied and if the surplus of upstream micro water is intercepted in downstream micro watershed then such links have been considered and in such cases only the surplus water from the downstream micro watershed has only been considered for further planning.

Step 7

Further, spills from existing upstream Major/Medium dams, if any (obtained from WEAP runs), has been added to get the total surplus water available for planning of new projects.

16.3 Search for Under-utilised / Surplus Water Resources

By far the biggest water use sector in the State is irrigated agriculture. Accordingly, the existing level of water utilization in Rajasthan is already well advanced.

However, on closer watch, the following are observable:

- There are niches of full or partial non-utilization, mostly caused by inadequate supply of expected to be imported water and/or not yet readiness of works to receive the water.
- There are few genuine surpluses of un-utilised state-own water resources.

The above discussion presents a point of view of entire districts, where pockets of 'left-over' harvestable water may still be encountered. These may probably not

justify full-scale projects at some places but may be utilised, e.g. for artificial recharge to groundwater aquifers.

Micro watershed wise water surplus analyses has been performed according to the methodology described in Section 16.2.3 above. The following sections present brief accounts of the analyses and relevant conclusions drawn.

The procedure applied has been affected on a micro watershed wise basis as per State Water Policy, aimed to identify under-utilised surface water resources; the procedure comprises an operation-wise computation of simulated annual flows less the actual water captured in identified existing water bodies i.e. dams and water harvesting structures (WHSs) in the considered areas.

The considered areas comprise that which lies downstream of the lowest existing Major/Medium dams in the basin/sub-basin studied; this area is defined as the "Free Remaining Area' (FRA) of the relevant basin/sub-basin.

The simulated flows that are considered in the operation procedure are the 38-years (1973-2010) series of simulated flows in the corresponding site.

The said operation process, as described in Section 16.2.3, intends to simulate the perception that annual inflows in the micro watersheds lying in the Free Remaining Area are captured in the existing water bodies (minor projects and WHSs). When the annual simulated inflow is more than the combined holding capacity of the water bodies, the surplus is determined, which may still be utilised in case an appropriate opportunity is available.

While this procedure is applicable for all the reviewed basins/sub-basins and micro watersheds, a reservation precaution must be raised where the simulated inflow at the case site involves capture areas lying outside of Rajasthan. In particular, this notice applies to:

- Chambal Basin: Parwati and Kali Sindh Sub-basins, and consequently Chambal Downstream Sub-basin.
- Mahi Basin: Anas Sub-basin.

The inflow data for these sub-basins case sites refer to catchment areas that large parts of them are situated in the upstream boundaries of Madhya Pradesh where further development (i.e. use and\or diversion of flows) is outside the jurisdiction of Rajasthan. Accordingly, the corresponding procedure output in these cases is only based on yield from Rajasthan catchment.

16.3.1 Shekhawati River Basin

Based on the adopted approach and methodology described in section 16.2 and the micro watershed wise surplus water analysis detailed in Final Report No. 4.7, the summary of under-utilized surplus surface water in sub-basins of Shekhawati Basin at 75% dependability is presented in Table 16.1.

Table 16.1: Surplus Water at 75% dependability in Shekhawati Basin, Mm³/yr

Basin	Sub-basin	2010	2020	2040	2060
Shekhawati	Dohan	13.07	13.20	13.47	13.73
	Kantli	4.63	4.63	4.63	4.63
	Mendha	2.62	2.62	2.62	2.62
Total Surplus		20.32	20.45	20.72	20.98

As per the sub-basin wise analyses of Shekhawati basin summarized in Table 16.1, there are very small quantities of surplus water available at 75% dependability in the basin micro watersheds. Surplus water of Dohan Sub-basin is scattered, which partly gets absorbed in the sandy strata and partly goes to neighbouring State. Surplus water of Kantli Sub-basin fully gets absorbed in the sandy strata within Rajasthan. Surplus water of Mendha Sub-basin feeds the Sambhar Lake, which has storage capacity of 138 Mm^3.

Considering the above analysis and minimum environmental yield requirement of 25.90 Mm^3 from Shekhawati basin, no new projects are planned in this basin.

16.3.2 Ruparail River Basin

Based on the adopted approach and methodology described in section 16.2 and the micro watershed wise surplus water analysis detailed in Final Report No. 4.7, the summary of under-utilized surplus surface water in Ruparail Basin at 75% dependability is presented in Table 16.2.

Table 16.2: Surplus Water at 75% Dependability in Ruparail Basin, Mm³/yr

Basin	Micro Watersheds	2010	2020	2040	2060
Ruparail	001	11.11	11.65	12.61	13.58
	002	23.56	23.60	23.62	23.66
	003	30.86	31.26	31.75	31.91
	006	4.88	4.88	4.88	4.88
	009	5.59	5.59	5.59	5.59
	010	0.97	0.97	0.97	0.97
	011	2.47	2.47	2.47	2.47
	012	2.42	2.42	2.51	2.64
Total Surplus		81.86	82.84	84.40	85.70

The surplus water in the free area below Sikri Bund at 75% dependability (MWS 006, 009, 010, 011 and 012) is 16.9 Mm^3, which spreads in the fields and utilized for agriculture.

River Ruparail terminates in Sikri Bund in the extreme east end of the Basin. The total length of this earthfill embankment is about 21.5 km, the overflow section is 115 m long, and the live storage capacity is 36.6 Mm^3, commanding a CCA of 10467 ha. From Sikri Bund the water drains through the overflow section and 28 outlet channels, and flows into some depressions. The depressions on the right-hand

side of the dam drain into Moti Jheel through Homes Canal, and those on the left-hand side drain into Kaman-Pahari Drain.

The surplus water in the free area of MWS 001, 002 and 003 at 75% dependability is 63.8 Mm^3, which also spreads in the fields and utilized for agriculture.

Considering the above analysis and minimum environmental yield requirement of 85.70 Mm^3 from Ruparail basin, no new projects are planned in this basin.

16.3.3 Banganga River Basin

Based on the adopted approach and methodology described in section 16.2 and the micro watershed wise surplus water analysis detailed in Final Report No. 4.7, the summary of under-utilized surplus surface water in Banganga Basin at 75% dependability is presented in Table 16.3.

Table 16.3: Surplus Water at 75% Dependability in Banganga Basin, Mm^3/yr

Basin	Micro Watersheds	2010	2020	2040	2060
Banganga	003	0.23	0.23	0.23	0.23
	004	0.27	0.27	0.27	0.27
	005	0.95	0.95	0.95	0.95
	006	0.49	0.49	0.49	0.49
	007	0.00	0.00	0.00	0.00
	008	1.37	1.37	1.37	1.37
	009	1.53	1.53	1.53	1.53
	010	0.87	0.87	0.87	0.87
	013	0.14	0.14	0.14	0.14
	025	2.71	2.71	2.71	2.71
	026	0.14	0.14	0.14	0.14
Total Surplus		8.70	8.70	8.70	8.70

As per the analyses presented above, there are very small quantities of surplus water available at 75% dependability in the basin micro watersheds, which also spreads in the fields and utilized for agriculture.

Considering the above analysis and minimum environmental yield requirement of 81.40 Mm^3 from Banganga basin, no new projects are planned in this basin.

16.3.4 Gambhir River Basin

Based on the adopted approach and methodology described in section 16.2 and the micro watershed wise surplus water analysis detailed in Final Report No. 4.7, the summary of under-utilized surplus surface water in Gambhir Basin at 75% dependability is presented in Table 16.4.

Table 16.4: Surplus Water at 75% Dependability in Gambhir Basin, Mm³/yr

Basin	Micro Watersheds	2010	2020	2040	2060
Gambhir	002	1.04	1.04	1.04	1.04
	003	0.49	0.49	0.49	0.49
	004	2.23	2.23	2.23	2.23
	005	18.97	18.97	18.97	18.97
	006	0.99	0.99	0.99	0.99
	007	2.18	2.18	2.18	2.18
	008	0.20	0.20	0.20	0.20
	009	5.62	5.62	5.62	5.62
	010	1.96	1.96	1.96	1.96
	011	2.55	2.55	2.55	2.55
	012	8.07	8.07	8.07	8.08
	015	1.45	1.45	1.45	1.45
Total Surplus		45.75	45.75	45.75	45.76

As per the analysis presented above, 45.8 Mm^3 of surplus water is available in Gambhir basin at 75% dependability in the basin micro watersheds. This water spreads in the fields and partly utilized for agriculture and partly goes into Gambhir River.

Considering the above analysis and minimum environmental yield requirement of 70.40 Mm^3 from Gambhir basin, no new projects are planned in this basin.

16.3.5 Parbati River Basin

Based on the adopted approach and methodology described in section 16.2 and the micro watershed wise surplus water analysis detailed in Final Report No. 4.7, the summary of under-utilized surplus surface water in Parbati Basin at 75% dependability is presented in Table 16.5.

Table 16.5: Surplus Water at 75% Dependability in Parbati Basin, Mm³/yr

Basin	Micro Watersheds	2010	2020	2040	2060
Parbati	001	1.64	1.64	1.64	1.64
	002	9.19	9.26	9.40	9.53
	012	5.33	5.34	5.37	5.39
	014	2.28	2.28	2.28	2.28
	015	8.57	8.57	8.57	8.57
	016	2.83	2.83	2.83	2.83
	017	8.98	8.98	8.98	8.98
	018	20.48	20.50	20.53	20.56
	019	5.81	5.84	5.90	5.96
	020	1.45	1.45	1.45	1.45
Total Surplus		66.56	66.69	66.95	67.19

The surplus water in the free area of micro watersheds (MWS 018, 019 and 015) below Parbati and Ramsagar dams is 34.9 Mm^3. Nine water harvesting structures have been planned by the water resources department on Parbati River and its tributaries downstream of Parbati dam in these micro watersheds, out of which seven are already under construction.

The surplus water in the free area of remaining micro watersheds (designated as "Lower Parbati Basin Area") is 31.7 Mm^3 at 75% dependability. Plans/Projects to utilise the surplus water in "Lower Parbati Basin Area" are discussed in detail in Chapter 7 of Final Report No. 4.7 and listed alongwith salient features in section 16.4.3 of this report.

16.3.6 Sabi River Basin

Based on the adopted approach and methodology described in section 16.2 and the micro watershed wise surplus water analysis detailed in Final Report No. 4.7, the summary of under-utilized surplus surface water in Sabi Basin at 75% dependability is presented in Table 16.6.

Table 16.6: Surplus Water at 75% Dependability in Sabi Basin, Mm^3/yr

Basin	Micro Watersheds	2010	2020	2040	2060
Sabi	003	0.60	0.71	0.93	1.15
	004	0.24	0.24	0.24	0.24
	005	0.03	0.03	0.03	0.03
	006	0.29	0.29	0.29	0.29
	007	0.49	0.49	0.49	0.49
	009	0.01	0.01	0.01	0.01
	010	0.03	0.03	0.03	0.03
	011	0.00	0.00	0.00	0.00
	018	8.87	8.91	8.98	9.06
Total Surplus		10.56	10.71	11.00	11.30

As per the analysis presented above, there are very small quantities of surplus water available at 75% dependability in the basin micro watersheds, which also spreads in the fields and utilized for agriculture.

Considering the above analysis and minimum environmental yield requirement of 27.80 Mm^3 from Sabi basin, no new projects are planned in this basin.

16.3.7 Banas River Basin

Based on the adopted approach and methodology described in section 16.2 and the micro watershed wise surplus water analysis detailed in Final Report No. 4.7, the summary of under-utilized surplus surface water in sub-basins of Banas Basin at 75% dependability is presented in Table 16.7.

Table 16.7: Surplus Water at 75% Dependability in Banas Basin, Mm^3/yr

Basin	Sub-basin	2010	2020	2040	2060
Banas	Banas	104.01	104.13	104.34	104.56
	Gudia	3.05	3.05	3.05	3.05
	Kalisil	3.00	3.00	3.00	3.00
	Mashi	9.34	9.34	9.34	9.34
	Morel	31.88	31.88	31.88	31.88
	Sodra	0.99	0.99	0.99	0.99
Total Surplus		152.27	152.39	152.60	152.82

The surplus water in the FRA, i.e. below Bisalpur Dam, Moti Sagar, Galwa, Surwal, Morel, Kali Sil, Mora Sagar, Dheel, Chandsen Bheru Sagar, Tordi Sagar, Chaparwara, Mashi, Kalakh Sagar and Hingoniya Dam is 152.3 Mm^3.

Part of this surplus water, 34.3 Mm^3 (surplus in MWS 001, 002, 060 and 070), will be captured in the proposed Isarda II dam. The proposed Isarda II dam of gross capacity of 304.97 Mm^3 has been proposed on Banas River downstream of Bisalpur Dam. 118.0 Mm^3 has been left untapped considering environmental flow from Banas basin.

Plans/Projects to utilise this surplus water are discussed in detail in Chapter 7 of Final Report No. 4.7. It is proposed to transfer 300.0 Mm^3 water from Anas River in Mahi Basin to Berach River in Banas Basin to augment existing Bisalpur dam and 173.7 Mm^3 from Mej River of Chambal Basin to augment the proposed Isarda II dam. These projects are also listed alongwith salient features in section 16.4.3 of this report.

16.3.8 Chambal River Basin

Based on the adopted approach and methodology described in section 16.2 and the micro watershed wise surplus water analysis detailed in Final Report No. 4.7, the summary of under-utilized surplus surface water in sub-basins of Chambal Basin at 75% dependability is presented in Table 16.8 considering the yield from Rajasthan catchment.

Table 16.8: Surplus Water at 75% Dependability in Chambal Basin, Mm^3/yr

Basin	Sub-basin	2010	2020	2040	2060
Chambal	Parwati	980.09	976.73	981.00	985.18
	Kunu	142.37	142.53	142.85	143.16
	Kalisindh	1,627.62	1,628.47	1,633.17	1,638.34
	Mej	340.33	340.84	341.29	341.58
	Chakan	78.26	79.01	79.01	80.51
	Chambal Downstream	831.08	831.61	832.65	833.72
Total Surplus		3,999.75	3,999.19	4,009.97	4,022.49

As per the sub-basin wise analyses of Chambal basin presented above, there are large quantities of surplus water available at 75% dependability in the basin micro watersheds.

Plans/Projects to utilize this surplus water are discussed in detail in Chapter 7 of Final Report No. 4.7 and listed alongwith salient features in section 16.4.3 of this report.

16.3.9 Mahi River Basin

Based on the adopted approach and methodology described in section 16.2 and the micro watershed wise surplus water analysis detailed in Final Report No. 4.7, the summary of under-utilized surplus surface water in sub-basins of Mahi Basin at 75% dependability is presented in Table 16.9 considering the yield from Rajasthan catchment.

Table 16.9: Surplus Water at 75% Dependability in Mahi Basin, Mm^3/yr

Basin	Sub-basin	2010	2020	2040	2060
Mahi	Mahi	299.92	312.48	318.03	323.51
	Jakham	235.96	237.25	239.75	242.22
	Som	45.20	45.73	46.76	47.75
	Moran	50.29	52.27	56.21	60.13
	Bhadar	16.46	17.34	19.10	20.86
	Anas	160.64	161.21	162.36	163.52
Total Surplus		808.47	826.28	842.21	857.99

As per the sub-basin wise analyses of Mahi basin presented above, there are large quantities of surplus water available at 75% dependability in the basin micro watersheds.

Plans/Projects to utilize this surplus water are discussed in detail in Chapter 7 of Final Report No. 4.7 and listed alongwith salient features in section 16.4.3 of this report.

16.3.10 Sabarmati River Basin

Based on the adopted approach and methodology described in section 16.2 and the micro watershed wise surplus water analysis detailed in Final Report No. 4.7, the summary of under-utilized surplus surface water in sub-basins of Sabarmati Basin at 75% dependability is presented in Table 16.10.

Table 16.10: Surplus Water at 75% Dependability in Sabarmati Basin, Mm³/yr

Basin	Sub-basin	2010	2020	2040	2060
Sabarmati	Sei	1.75	1.75	1.75	1.75
	Vatrak	6.98	6.98	6.98	6.98
	Wakal	35.55	35.55	35.55	35.55
	Sabarmati	17.53	17.53	17.53	17.53
Total Surplus		61.81	61.81	61.81	61.81

As per the sub-basin wise analyses of Sabarmati basin summarized above, there are small quantities of surplus water in the micro watersheds of Sei, Vatrak, Wakal and Sabarmati basin at 75% dependability, but since most of the micro watersheds are draining directly into neighbouring State, there is very little scope to harness this surplus water and even if harnessed, utilization is not feasible due to land use and topography.

Considering the above analysis and minimum environmental yield requirement of 46.30 Mm^3 from Sabarmati basin and ongoing and proposed projects of Government of Rajasthan in the basin, no new projects are planned in this basin.

16.3.11 Luni River Basin

Based on the adopted approach and methodology described in section 16.2 and the micro watershed wise surplus water analysis detailed in Final Report No. 4.7, the summary of under-utilized surplus surface water in sub-basins of Luni Basin at 75% dependability is presented in Table 16.11.

Table 16.11: Surplus Water at 75% Dependability in Luni Basin, Mm³/yr

Basin	Sub-basin	2010	2020	2040	2060
Luni	Jojri	0.06	1.48	7.21	11.68
	Guhiya	0.04	0.04	0.04	0.04
	Bandi (Hemawas)	0.00	0.00	0.00	0.00
	Khari (Hemawas)	0.00	0.00	0.00	0.00
	Sukri	0.01	0.01	0.01	0.01
	Mithari	1.58	1.58	1.58	1.58
	Jawai	5.77	5.77	5.77	5.77
	Khari	3.14	3.14	3.14	3.14
	Bandi	0.07	0.07	0.07	0.07
	Sukri (Sayla)	0.00	0.00	0.00	0.00
	Sagi	2.15	2.15	2.15	2.15
	Luni	14.11	14.41	14.75	15.14
Total Surplus		26.93	28.65	34.72	39.58

As per the sub-basin wise analyses of Luni basin presented above, there are very small quantities of surplus water available at 75% dependability in the basin micro watersheds. Also, this surplus water gets absorbed within its micro watersheds.

Therefore, no new projects are planned in this basin.

16.3.12 West Banas River Basin

Based on the adopted approach and methodology described in section 16.2 and the micro watershed wise surplus water analysis detailed in Final Report No. 4.7, the summary of under-utilized surplus surface water in West Banas Basin at 75% dependability is presented in Table 16.12.

Table 16.12: Surplus Water at 75% Dependability in West Banas Basin, Mm^3/yr

Sub-basin	Micro Watersheds	2010	2020	2040	2060
West Banas	001	2.90	2.90	2.91	2.91
	004	1.72	1.72	1.72	1.72
	005	0.08	0.08	0.08	0.08
	006	0.62	0.62	0.62	0.62
	007	0.60	0.60	0.60	0.60
	008	0.62	0.62	0.62	0.62
	010	1.69	1.69	1.69	1.69
	011	1.87	1.87	1.87	1.87
	012	0.70	0.70	0.70	0.70
	013	3.22	3.22	3.22	3.22
	014	1.15	1.15	1.15	1.15
Total Surplus		15.17	15.17	15.18	15.18

As per the analyses presented above, there are small quantities of surplus water available at 75% dependability in the basin micro watersheds.

Considering the above analysis and minimum environmental yield requirement of 15.90 Mm^3 from West Banas basin, no new projects are planned in this basin.

16.3.13 Sukli River Basin

Based on the adopted approach and methodology described in section 16.2 and the micro watershed wise surplus water analysis detailed in Final Report No. 4.7, the summary of under-utilized surplus surface water in Sukli Basin at 75% dependability is presented in Table 16.13.

Table 16.13: Surplus Water at 75% dependability in Sukli Basin, Mm^3/yr

Sub-Basin	Micro Watersheds	2010	2020	2040	2060
Sukli	001	0.39	0.39	0.39	0.39
	002	0.56	0.56	0.56	0.56
	003	1.05	1.05	1.05	1.05
	005	1.06	1.06	1.06	1.06
	006	0.43	0.43	0.43	0.43
	007	0.16	0.16	0.16	0.16
	008	0.02	0.02	0.02	0.02

Sub-Basin	Micro Watersheds	2010	2020	2040	2060
	009	0.11	0.11	0.11	0.11
	011	0.01	0.01	0.01	0.01
Total Surplus		3.79	3.79	3.79	3.79

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As per the analyses presented above, there are very small quantities of surplus water available at 75% dependability in the basin micro watersheds.

Considering the above analysis and minimum environmental yield requirement of 3.80 Mm^3 from Sukli basin, no new projects are planned in this basin.

16.3.14 Other Nallahs of Jalore River Basin

Based on the adopted approach and methodology described in section 16.2 and the micro watershed wise surplus water analysis detailed in Final Report No. 4.7, the summary of under-utilized surplus surface water in Other Nallahs of Jalore Basin at 75% dependability is presented in Table 16.14.

Table 16.14: Surplus Water at 75% Dependability in Other Nallahs of Jalore Basin, Mm^3/yr

Sub-basin	Micro Watersheds	2010	2020	2040	2060
Other Nallahs of Jalore	001	0.01	0.01	0.01	0.01
	002	0.12	0.12	0.12	0.12
	003	0.10	0.10	0.10	0.10
	004	0.03	0.03	0.03	0.03
	005	0.16	0.16	0.16	0.16
	006	0.02	0.02	0.02	0.02
	007	0.26	0.26	0.26	0.26
	008	0.63	0.65	0.69	0.70
	009	0.23	0.23	0.23	0.23
Total Surplus		1.56	1.58	1.62	1.63

As per the analyses presented above, there are very small quantities of surplus water available at 75% dependability in the basin micro watersheds, which also spreads in the fields and utilized for agriculture.

Considering the above analysis and minimum environmental yield requirement of 2.10 Mm^3 from Other Nallahs of Jalore basin, no new projects are planned in this basin.

16.3.15 Ghaggar River Basin

As per the surface water assessment very small quantities of surface water are generated within the State. This area mainly receives Ghaggar flood water from Ottu Weir in Haryana. The utilization of Ghaggar flood water is discussed below.

Utilization of Ghaggar Flood Water

The Ghaggar river enters in Rajasthan near Talwara Jheel village in Hanumangarh District. Ghaggar River siphons below Indira Gandhi Feeder (IGF) at RD 629 from where Ghaggar Diversion Channel has been constructed. Ghaggar Diversion Channel (GDC) ultimately discharges water in artificial depressions constructed near Suratgarh. Length of GDC is RD 158.7, total no. of depressions are 18 and their storage capacity is 900.44 Mm^3 (0.73 MAF). These depressions are inter-linked through cuts.

From RD 24 of GDC water is released in Ghaggar Nail Bed. Ghaggar Nali passes near Hanumangarh, Suratgarh and ultimately crosses Indo-Pak border near Anoopgarh. To protect life and properties from Ghaggar Flood, protection works and structures for utilization of flood water have been constructed. Ghaggar flood water is utilized for irrigation directly from GDC/Ghaggar Nali Bed as well as from water stored in depressions.

Maximum water received at RD 0 of GDC (Ghaggar siphon RD 629 of IGF) is as below:

S. No	Year	Maximum Discharge in cusecs
1	2000	13,759
2	2001	7,798
3	2002	5,060
4	2003	5,366
5	2004	13,013
6	2005	5,009
7	2006	2,900
8	2007	4,402
9	2008	8,152
10	2009	7,344
11	2010	13,050

Therefore, about 13,000 cusecs maximum flood water has been received during last 11 years.

Utilization of Ghaggar Flood water through existing system:

S. No.	Particular	Discharge, cusecs
1	129 Outlets in GDC	300
2	Intake structure at RD 133 of GDC to divert water in SOG Branch	1,850

S. No.	Particular	Discharge, cusecs
3	Intake structure at RD 43 of Anoopgarh Branch to divert water from Ghaggar Nali Bed to Anoopgarh Branch	1,650
4	6 Nos existing channels have been linked with GDC to supplement water from GDC: South Ghaggar Canal 162.20 Kishanpura Distributary 29.43 Munda Minor 21.56 Naurangdeshar Distributary 227.70 High level Minor 14.56 Zorawarpura Minor 5.21 Total 460.66	460
5	Cultivators also utilize water from Ghaggar Nali Bed through Syphons and Pumps. The approximate quantity is	1,000
6	Losses in GDC and Ghaggar Nali Bed	2,000
	Total	**7,260**

Thus 7,260 cusecs water can be utilized directly from GDC and Ghaggar Nali Bed. In addition to this 5,000 cusecs water can be released in depression from tail GDC (RD 158.7), thus total discharge that can be utilized is 7,260+5,000=12,760 cusecs (say 12,800 cusecs).

Intake structure at RD 629 of IGF has also been constructed to divert 10,000 cusecs water in IGF but water through this intake structure can be diverted when receipt of water is more than 25,000 cusecs.

Therefore about 12,800 cusecs water can be safely utilized through Existing System.

For utilization of water stored in depressions following structure has been constructed:

S. No.	Name of work	Design Discharge, cusecs
1	Manaktheri Minor	25.00
2	Kishanpura Minor	13.50
3	Farm Minor	120.00
4	Pilibangan Karnising Link channel	310.00
5	Escape channel S-8A to divert water from depressions to Ghaggar Nali Bed.	3,000.00

Thus, entire flood water upto 13,000 cusecs can be utilized through existing system.

16.3.16 Outside Basin

This basin occupies a very large area of 130,522.48 km^2 in the western part of the Rajasthan State and covers entire Districts of Jaisalmer and Bikaner and parts of Districts of Barmer, Jodhpur, Nagaur, Sikar, Ganganagar, Hanumangarh, Jaisalmer, Jhunjhunun and Churu.

The Outside Basin constitutes a closed basin, as drainage is not clearly defined, originating and ending within the plain itself. Owing to scanty rainfall, the streams carry only peak flood waters and are ephemeral in nature, while their channels are ill-defined and disappear in the desert after travelling a short distance.

16.3.17 Summary of Search for Under-utilised / Surplus Surface Water

The summary of under-utilized/ surplus surface water is presented in Table 16.15. This aspect of the study has been presented in detail in Final Report No. 4.7.

Table 16.15: Summary of Search for Under-utilised / Surplus Surface Water

Basin	Sub-basin	Surplus Water at different dependability, Mm^3		Proposed Use / Remarks
		50%	75%	
Shekhawati	Dohan	88.08	13.07	No new project proposed, part of this water spreads in fields and utilized for agriculture.
	Kantli	14.32	4.63	No new project proposed, this water gets absorbed in sandy strata.
	Mendha	5.10	2.62	No new project proposed, this water goes to Sambhar Lake.
	Total	107.51	20.32	
Ruparail		249.86	81.86	No new project proposed, as this water spreads in fields and utilized for agriculture.
Banganga		77.02	8.70	No new project proposed.
Gambhir		250.24	45.75	No new project proposed, part of this water spreads in fields and utilized for agriculture, balance is allowed to flow in Gambhir river which joins Yamuna river.
Parbati		171.97	66.56	To utilize this surplus water, 9 water harvesting structures of WRD are under construction. Consultants have also proposed 15 percolation tanks and cross-stream structures to partly utilize this surplus water.
Sabi		64.59	10.56	No new project proposed, as this water spreads in fields and utilized for agriculture.
Banas	Banas	250.72	104.01	34.3 Mm^3 to be intercepted by proposed Isarda dam.
	Gudia	8.68	3.05	No new project proposed.
	Kalisil	21.42	3.00	No new project proposed.
	Mashi	16.20	9.34	No new project proposed.
	Morel	102.21	31.88	No new project proposed.
	Sodra	6.88	0.99	No new project proposed.
	Total	406.12	152.27	
Chambal	Parwati	1,510.90	980.09	Partly utilized by within-sub-basin proposed projects. Balance contributes to Chambal downstream sub-basin.
	Kunu	220.22	142.37	No new project proposed.
	Kalisindh	2,884.45	1627.62	Partly utilized by within-sub-basin proposed projects. Balance contributes to Chambal downstream sub-basin.
	Mej	649.43	340.33	Mostly utilized by within-sub-basin proposed

Basin	Sub-basin	Surplus Water at different dependability, Mm^3		Proposed Use / Remarks
		50%	75%	
				projects. Balance contributes to Chambal downstream sub-basin.
	Chakan	163.32	78.26	No new project proposed.
	Chambal Downstream	1,227.28	831.08	This amount and contribution from upstream sub-basins is partly utilized by within-sub-basin projects. Balance left as per minimum environmental norms of MoEF.
	Total	6,655.60	3999.75	1757.38 Mm^3 to be utilized by various proposed projects. Balance left as per minimum environmental norms of MoEF.
Mahi	Mahi	652.49	299.92	Outflow after implementing proposed projects
	Jakham	320.48	235.96	Partly utilized by within-sub-basin proposed projects. Balance contributes to Mahi sub-basin.
	Som	105.17	45.20	No new project proposed, contributes to Mahi sub-basin.
	Moran	141.51	50.29	No new project proposed, contributes to Mahi sub-basin.
	Bhadar	53.98	16.46	No new project proposed.
	Anas	313.37	160.64	Partly utilized by within-sub-basin proposed projects. Balance contributes to Mahi sub-basin.
	Total	1,587.00	808.47	
Sabarmati	Sei	18.99	1.75	No new project proposed.
	Vatrak	53.82	6.98	No new project proposed.
	Wakal	106.91	35.55	No new project proposed.
	Sabarmati	55.65	17.53	No new project proposed.
	Total	235.37	61.81	
Luni	Jojri	0.51	0.06	No new project proposed.
	Guhiya	0.07	0.04	No new project proposed.
	Bandi (Hemawas)	0.04	0.00	No new project proposed.
	Khari (Hemawas)	0.00	0.00	No new project proposed.
	Sukri	0.04	0.01	No new project proposed.
	Mithari	3.73	1.58	No new project proposed.
	Jawai	10.89	5.77	No new project proposed.
	Khari	6.99	3.14	No new project proposed.
	Bandi	0.63	0.07	No new project proposed.
	Sukri (Sayala)	0.02	0.00	No new project proposed.
	Sagi	4.64	2.15	No new project proposed.
	Luni	37.43	14.11	No new project proposed.
	Total	64.99	26.93	
West Banas		32.66	15.17	No new project proposed.
Sukli		13.24	3.79	No new project proposed.
Other Nallahs of Jalore		8.31	1.56	No new project proposed.
Ghaggar		-	-	No new project proposed.
Outside		-	-	No new project proposed.

16.4 Identification of New Water Projects

16.4.1 Introduction

Proposal for new projects to be implemented in water surplus basins are based on project design reports as available, desk-top studies and basic data on water availability. A review of the main dimensions of planned irrigation projects and their consistency with the Consultants' revised water yield assessments was carried out under other parts of the Project.

The main characteristics and cost estimate are defined to serve as the basis for carrying out economic analysis of planned projects and programmes.
The analysis also indicates in what parts of the basin there is excess water available for utilization. This information was then used for appraising planned projects and planning additional future projects by assessing the availability of water for irrigation and/or other water supply. Utilization of existing excess storage has also been considered in planning.

16.4.2 Project Appraisal Procedure

The appraisal of new projects comprises:

- Establishing the availability of water under given dependability levels (90%, 75%, 50% and 25%).
- Identifying the type of project.
- Estimating the capital and O&M costs.
- Estimating the anticipated benefits.

The analysis culminated in assessment of economic indicators for the project that guided in decision-making on its implementation.

16.4.2.1 General

The assessment of net availability of surface water for planned reservoirs allows for evaporation and seepage losses as well as priority requirement for surface water for other than irrigation purposes from the same dam.

The potential for utilizing groundwater in conjunction with surface water in planned irrigation projects is taken into account when analysing the total availability of water. The total amount of groundwater utilizable for irrigation may include:

- Natural replenishment within the command area.
- Return flows, i.e. percolation from water conveyance systems.
- Artificial recharge, if any.
- Aquifer mining, if applicable.

When return flow from irrigation and other water conveyance systems are taken into account over the long term, the need for groundwater utilization in the command area often becomes a must if an excessive build-up of groundwater levels and possibly water logging of irrigated areas is to be avoided.

The adequacy of the pumping capacity of planned lift schemes has been examined and, if necessary, due adaptations in the design has been recommended. In addition, the supply capacity of the planned pump station has been compared with the water requirements of the target irrigated area and, if necessary, amendments have been recommended.

16.4.2.2 Storage Capacity

The storage capacity within the selected projects is evaluated regarding the catchment yield and the siltation process up to the end of the planning horizon (Year 2060).

In cases where the remaining storage capacity is smaller than the annual catchment yield at 75% dependability, then the storage capacity is considered for extension considering the available cultivable area or demand for other purposes, while in cases where the storage capacity is in excess, water diversion from other areas have been considered.

16.4.2.3 Groundwater Utilization

Groundwater availability for irrigation within the command area is calculated taking into account the natural aquifer replenishment as well as irrigation return flows, after deducting for the supply of groundwater for other priority purposes.

The mode of groundwater utilization in conjunction with surface water for irrigation would depend on the aquifer characteristics and ability to provide an effective multi-annual storage capacity.

16.4.2.4 Cost Estimates

After reviewing the performance of the projects, including recommended amendments if relevant, their cost estimate have been reviewed and updated to common level of 2010 price level. In case cost estimates are not available, costs have been estimated using unit costs analyses.

16.4.2.5 Dams and Irrigation Projects

The assessment of water availability at individual dam sites with refined estimates of surplus surface water potential at micro watershed level indicates in which basin/sub-basin there is scope for harvesting additional quantities.

The technical feasibility of constructing dams and reservoirs as planned have been evaluated based on the revised surface water yield at the considered site, taking into account existing upstream and downstream dams.

Wherever estimates prepared by WRD are available, these have been reviewed and updated. For other projects, preliminary cost estimates have been prepared based on unit costs per stored volume in m^3. For canal systems in major and medium irrigation projects the cost have been estimated on basis of unit cost per hectare,

derived for different categories of projects according to recently constructed or planned projects.

16.4.2.6 Lift Schemes

In river reaches where it is found that excess flow remains even in non-Monsoon period after developing all the suitable dams and harvesting as much as possible the basin's surface water by gravity, the possibility of introducing lift schemes has been examined, considering that there is suitable land for irrigation at a reasonable elevation difference.

Considering the relatively high cost involved, lift schemes have been primarily considered in river reaches where water is available as mentioned above.
There is also scope for planning lift schemes on main canals of existing irrigation systems where lift schemes can make it possible to increase the utilization of available water and command additional irrigable land. In few such cases, the project planning defined as basis for economic analysis includes the respective costs and additional CCA.

Engineering considerations, such as suitable topographical, hydrological and geological data, has been taken into consideration for sitting the associated structures. If necessary, a weir is also planned in the river to provide adequate depth of water for pumping.

The cost of pump stations have been estimated on basis of the latest available unit costs per m^3/sec/m or kW. The cost of civil works is assessed on relevant unit costs. The annual cost of power supply is also included.

16.4.2.7 Inter-basin Transfer Projects

The surplus runoff, if any, in a basin can even be used in adjoining basins. Inter-basin transfers have been examined taking into consideration refined estimates of water availability and demand. This has been done in stages after concluding the state water balance and establishing the economic viability of all future water projects. This forms the basis for identifying options for such transfers.

16.4.2.8 Enhanced Groundwater Recharge

a. General

The extent of overexploitation of groundwater resources, on one hand, and, on the other hand, the expectation of considerable number of 'left-over' water occurrences brought the authorities' attention to the probability of using such 'left-overs' for artificially enhanced recharge of groundwater. A landmark in this respect is the Master Plan for Artificial Recharge to Groundwater in India, prepared by the Government of India, Ministry of Water Resources, Central Ground Water Board (New Delhi 2002). This study's review of several means that might be implemented – probably employing several in certain areas – is applicable to Rajasthan and is briefly reproduced hereunder.

b. Criteria for Choosing Artificial Recharge Sites

Local conditions and hydrogeological characteristics at the location of an artificial recharge site play a major role in determining the efficiency of the scheme. Therefore, close attention and efforts should be given in order to wisely identify the best available site for enhanced groundwater recharge project. The main guidelines for choosing the site include the following:

- High permeability at the surface.
- High vertical hydraulic conductivity along the vadose zone to enhance fast percolation.
- Sufficient thickness of the unsaturated column in light of the storativity and estimated recharge volumes (to avoid groundwater emergence at the surface).
- Absence of low permeability horizons along the vadose zone, which may retard deep percolation.
- Sufficient lateral transmissivity in the aquifer to prevent extensive groundwater mounding below recharge zone.
- Acceptable quality of the recharged aquifer within permissible standards in light of the type of usage.
- Exploitation tools downstream of the recharged zone.
- Monitoring wells for optimal management.

The areas feasible for artificial groundwater recharge have been categorised as follows as per specifically considered for Rajasthan in Master Plan for Artificial Recharge to Ground Water in India, CGWB:

- Areas showing declining groundwater level trend of more than 0.20 m/yr and water level more than 3 m bgl.
- Areas showing declining groundwater level trend of more than 0.10 m/yr and water level more than 9 m bgl.
- Areas having water level more than 20 m bgl.

The artificial recharge to ground water aims to address the following issues:

- To enhance the sustainable yield in areas where over-development has depleted the aquifer.
- Conservation and storage of excess surface water for future requirements.
- To improve the quality of existing ground water through dilution.

It could take place in the following manners:

- Construction of percolation tanks, that may act at the same time for storage of runoff and percolation for aquifer recharge, provided with recharge/percolation shafts.
- Provision of cascade cross-stream structures with recharge/percolation shafts across the streams and drains of the selected area. Such structures would regulate flash-flood nature of runoff and give it opportunity to percolate.

c. Other Considerations

According to site conditions, other means may be employed for recharging water to depleting aquifers. Conditions for this purpose are, but not limited to:

- Since percolation takes more time than the surface flows and definitely much more when it relates to flash floods, it requires detainment of flows as much as practical. Any storage means may serve, including small ponds, village and livestock watering holes, etc.
- Monitoring and regulation of water for infiltration are cardinal for efficiency of the process: fast release, beyond the infiltration rate may cause spills, and extended interim storage may entail more evaporation losses.
- Since the recharge task is expensive, the target aquifer(s) should be properly defined and the works and means must be selected carefully to ascertain that the proposed aim is achieved.

16.4.3 Identified New Projects

According to surplus water availability assessment presented in Table 16.15, various plans/projects to utilize the above surplus water were studied by the Consultants, keeping in view the minimum environmental flow requirements as per the norms of MoEF and socio economic viability criteria. Accordingly, new projects have been identified in Parbati basin, Banas basin, Chambal basin, and Mahi basin. Table 16.16 presents the proposed projects considered by the Consultant to utilize the surplus water keeping in view priority of drinking water requirements in scarcity areas. The location of these projects is shown in Map of Development Plans given at the end of this report. The detailed study of these projects considering water availability and socio economic viability has been presented in Final Report No. 4.7.

16.4.4 Inter-basin Water Transfer / River Linking Projects

To utilize the surplus water of Chambal and Mahi basin, following inter-basin water transfer / river linking projects have been proposed by the Consultants to reduce deficits in nearby basins.

- Chambal river (Chambal basin) to Panchana dam in Gambhir basin
- Chambal river (Chambal basin) to Jaisamand dam (Alwar) in Ruparail basin
- Mej river (Chambal basin) to Ramgarh dam (Banganga basin) and Isarda dam (Banas basin)
- Anas river (Mahi basin) to Jaisamand dam (Udaipur) in Mahi basin; and Rajsamand dam, Meja dam and Bisalpur dam in Banas basin

A Special Project Planning and Monitoring (SPPM) Cell has been recently created in Water Resources Department, Rajasthan to identify various river linking projects and prepare preliminary concept reports so that detailed studies can be carried out for these identified projects on priority.

Table 16.16: Summary of Proposed Projects

S. No.	Project Code	Project Name	Latitude	Longitude	Basin	Sub-basin	Micro-watershed	Type of Project	Gross Capacity, Mm^3	CCA, ha	Estimated Cost, Million Rs.	Remarks
1	PAR-1	Artificial Groundwater Recharge Project	26°42'04.414"	77°43'10.501"	Parbati	Parbati	PAR MWS 002	WHS	9.28	-	46.05	15 percolation tanks & 57 cross-stream structures for groundwater recharge
2	BAN-1	Isarda Project	26°06'35.604"	76°00'25.020"	Banas	Banas	BAN MWS 002	Major	304.97	-	3,060.00	Drinking Water project
3	CHM-1	Parwan Project	24°35'45.420"	76°31'06.960"	Chambal	Kali Sindh	CHM MWS 039	Major	490.00	131,400	22,711.80	Multi-purpose project
4	CHM-2	Kali Sindh	24°29'52.188"	76°13'14.268"	Chambal	Kali Sindh	CHM MWS 035	Major	148.00	14,478	14,150.99	Multi-purpose project
5	CHM-3	Indira Lift	26°00'12.420"	76°49'08.148"	Chambal	Chambal Downstream	CHM MWS 005	Major	353.85	104,845	5,773.67	Drinking cum Irrigation Project
6	CHM-4	Dhaulpur Lift	26°39'42.264"	77°55'52.212"	Chambal	Chambal Downstream	CHM MWS 009	Major	74.70	34,465	1,279.50	Drinking cum Irrigation Project
7	CHM-5	Chambal-Panchna Lift	26°15'32.159"	77°14'23.657"	Chambal	Chambal Downstream	CHM MWS 005	Major	28.01	3,135	2,820.00	Inter-basin transfer for Drinking cum Irrigation purpose
8	CHM-6	Chambal to Jaisamand (Alwar) Lift	26°39'29.638"	77°54'02.812"	Chambal	Chambal Downstream	CHM MWS 010	Major	107.22	40,950	5,654.20	Inter-basin transfer for Irrigation purpose
9	CHM-7	Manohar Thana	24°13'06.744"	76°48'28.944"	Chambal	Kali Sindh	CHM MWS 042	Medium	84.76	14,049	2,471.13	Drinking cum Irrigation Project
10	CHM-8	Rajgarh Project	24°14'48.000"	75°53'15.000"	Chambal	Kali Sindh	CHM MWS 023	Medium	58.91	6,827	2,033.82	Drinking cum Irrigation Project
11	CHM-9	Mej to Ramgarh Lift Scheme	25°34'27.844"	76°07'58.412"	Chambal	Mej	CHM MWS 052	Medium	317.59	60,080	19,829.54	Inter-basin transfer for Drinking cum Irrigation purpose
12	CHM-10	Hatiyadeh	25°15'56.844"	76°42'21.204"	Chambal	Parwati	CHM MWS 058	Medium	46.97	6,885	1,646.59	Drinking cum Irrigation Project
13	CHM-11	Andheri	24°34'36.768"	76°47'28.716"	Chambal	Parwati	CHM MWS 055	Medium	45.29	7,700	1,358.18	Drinking cum Irrigation Project
14	CHM-12	Pipalda Lift	25°54'37.728"	76°38'50.064"	Chambal	Chambal Downstream	CHM MWS 007	Medium	23.26	12,930	919.60	Drinking cum Irrigation Project
15	CHM-13	Bor Band	24°10'28.992"	76°31'38.460"	Chambal	Kali Sindh	CHM MWS 029	Minor	0.67	133	26.83	Irrigation project
16	CHM-14	Guradia	24°24'38.052"	76°04'33.312"	Chambal	Kali Sindh	CHM MWS 026	Minor	4.49	1,509	232.67	Irrigation project
17	CHM-15	Rizone	24°21'30.744"	76°16'46.308"	Chambal	Kali Sindh	CHM MWS 035	Minor	0.63	129	25.52	Irrigation project
18	CHM-16	Anwa	24°55'43.212"	76°06'34.884"	Chambal	Kali Sindh	CHM MWS 033	Minor	0.76	187	35.32	Irrigation project

S. No.	Project Code	Project Name	Latitude	Longitude	Basin	Sub-basin	Micro-watershed	Type of Project	Gross Capacity, Mm^3	CCA, ha	Estimated Cost, Million Rs.	Remarks
19	CHM-17	Bherupura	24°49'34.608"	76°25'33.780"	Chambal	Kali Sindh	CHM MWS 038	Minor	1.05	150	40.36	Irrigation project
20	CHM-18	Sathoor Mata	25°26'38.364"	75°31'06.204"	Chambal	Mej	CHM MWS 053	Minor	0.71	209	44.62	Irrigation project
21	CHM-19	Bada Nayagaon	25°30'35.244"	75°30'15.480"	Chambal	Mej	CHM MWS 053	Minor	5.96	606	237.13	Irrigation project
22	CHM-20	Radi	25°08'42.396"	76°52'06.636"	Chambal	Parwati	CHM MWS 060	Minor	4.92	901	229.83	Irrigation project
23	CHM-21	Neveli	25°09'19.368"	77°07'05.736"	Chambal	Parwati	CHM MWS 059	Minor	3.93	614	159.26	Irrigation project
24	CHM-22	Dohri	26°09'03.960"	76°55'38.604"	Chambal	Chambal Downstream	CHM MWS 005	Minor	8.11	1,002	239.70	Irrigation project
25	CHM-23	Gopal Sagar	26°20'59.568"	77°13'38.604"	Chambal	Chambal Downstream	CHM MWS 010	Minor	1.39	198	52.26	Irrigation project
26	CHM-24	Ram Sagar	26°22'58.188"	77°19'01.308"	Chambal	Chambal Downstream	CHM MWS 010	Minor	1.67	238	62.94	Irrigation project
27	CHM-25	Krishna Sagar	26°16'14.988"	77°06'15.156"	Chambal	Chambal Downstream	CHM MWS 005	Minor	7.07	1,012	264.66	Irrigation project
28	MAI-1	Anas to Rajsamand & Bisalpur	23°26'19.277"	74°02'36.075"	Mahi	Anas	MAI MWS 001	Major	670.00	51,000	36,813.00	Inter-basin transfer for Drinking cum Irrigation purpose
29	MAI-2	Jakham to Jaisamand Dam (Udaipur)	23°38'10.739"	74°31'12.543"	Mahi	Mahi	MAI MWS 024	Major	132.00	8,000	730.47	Drinking cum Irrigation Project
30	MAI-3	Handa Khera	24°01'33.096"	74°21'53.424"	Mahi	Jakham	MAI MWS 011	Minor	13.97	1,998	527.49	Irrigation project
31	MAI-4	Tidiya Deh	23°14'11.868"	74°19'49.188"	Mahi	Anas	MAI MWS 004	Minor	2.70	347	76.55	Irrigation project
32	MAI-5	Moti-Tambi	23°17'18.000"	74°09'16.000"	Mahi	Anas	MAI MWS 002	Minor	2.52	232	98.59	Irrigation project
33	MAI-6	Dam at Anas River	23°20'27.794"	74°14'00.748"	Mahi	Anas	MAI MWS 002	Medium	63.12	-	1,560.32	Supplement to Mahi command

NOTE: Each project is designed area-specific and the water requirement of projects depends on cultivable area available and the crops considered and irrigation intensity, hence the gross capacity and CCA is not comparable.

17. Water Supply and Demand Balance

17.1 Introduction

The Consultants have approached the water supply and demand with a special sense of importance, because its outcome is a water balance that should guide the planning and priority of new development schemes with particular attention to the higher priority for drinking water supplies and possible need to provide for future reserve allocations for that sector. Priorities of water allocation between different sectors of water uses has been based on the State Water policy, February 2010.

The surface water availability from within Rajasthan has been considered for present (2010) and for future planning stages of 2020, 2040 and 2060 and at four dependability levels of 90%, 75%, 50% and 25% considering the storage/diversion capacities of Major, Medium and Minor projects as well as other water harvesting structures such as anicuts, nadis, talabs, etc. The share of Rajasthan in outside State waters (imported water) has also been considered for present (2010) and for future planning stages of 2020, 2040 and 2060 and at four dependability levels of 90%, 75%, 50% and 25% as per the inter-State agreements. The long-term fresh dynamic groundwater availability considering groundwater quality has only been considered as available for utilization as per Final Report No. 4.2 and 4.4.

Water demand of various non-agricultural sectors i.e. domestic, livestock, institutions, cooling of power stations, wildlife and industries as well as irrigated agriculture has been assessed for present (2010) and for future planning stages of 2020, 2040 and 2060 and at four dependability levels of 90%, 75%, 50% and 25%, as applicable.

Based on the water availability and water demands, the water supply and demand balance has been carried out for the 16 different scenarios considering the present and future planning stages and various dependability levels using **W**ater **E**valuation **A**nd **P**lanning (WEAP) tool.

The Water Evaluation and Planning (WEAP) system aims at incorporating the water availability and demand into a practical tool for water resources planning. WEAP is distinguished by its integrated approach to simulating water systems and by its strategy flexibilities. WEAP places the demand side of the equation - various water use and its patterns, equipment efficiencies, and allocation - on an equal footing with the supply side - streamflow, groundwater, reservoirs and water transfers. WEAP is a laboratory for examining alternative water development and management strategies.

WEAP is comprehensive, straightforward and easy-to-use, and attempts to assist rather than substitute the skilled planner. As a database, WEAP provides a system for maintaining water demand and supply information. As a forecasting tool, WEAP simulates water demand, supply, flows, and storage. As a policy analysis tool, WEAP evaluates a full range of water development and management options, and takes account of multiple and competing uses of water systems.

17.2 Methodology

Whereas water demands are analysed and quantified by districts and blocks, the potential of water resources to meet these demands must be quantified per river basin. Therefore, the methodology of water balance is two-tiered: 1) studying the demand for water by the different consumption sectors in each of the State's 33 districts and 249 blocks and then converting them to basin/ sub-basin/ micro watershed level; 2) studying water resources availability for supply in each river basin/ sub-basin/ micro watershed and subsequently, estimating the water resources availability for supply for each block and district considering the location of storage/diversion structures and their respective supply areas.

17.3 Priorities

According to the document State Water Policy (SWP), February 2010, State Water Resources Planning Department, Rajasthan, Jaipur, water allocation priorities for water resources management and planning purposes, are as follows:

human drinking water
livestock drinking water
other domestic, commercial and municipal water uses
agriculture
power generation
environmental and ecological
industrial
non-consumptive uses, such as cultural, leisure and tourist uses

The SWP also states that any departure from the above priorities will require consideration on a case-by-case basis.

17.4 Water Balance Assessments

Water Balance Assessments have been carried out block-wise and then aggregated to district level and also carried out micro watershed wise and then aggregated to sub-basin and basin level. The block-wise/district-wise water balances along with demand and supply details have been presented in detail in Final Report No. 4.6 and similarly the basin-wise/sub basin-wise/micro watershed-wise water balances along with demand and supply details have been presented in detail in Final Report No. 4.7.

To understand various components of water supply and demand balance performed on the administrative units a map of Rajasthan representing the main features of the 33 districts and 249 blocks is given at the end of this report (Main Features of Blocks related to Water Balance). This map helps to visualize the location of the following elements: districts, blocks, towns, industries, power plants, river basins, major/medium dams or diversion and their associated command area.

Similarly, to understand various components of water supply and demand balance performed on hydrological units a map of Rajasthan representing the main features

of 16 basin, 58 sub-basins and 541 micro watersheds is also given at the end of this report (Main Features of Micro Watershed related to Water Balance). This map helps to visualize the location of the following elements: river basin, sub-basin, micro watershed, towns, industries, power plants, major/medium dams or diversions and their associated command area.

The object behind carrying out the water balances also on administrative units is to enable the administrative authorities take decision and actions in their respective areas, which when done basin/ sub-basin/ micro watershed wise does not define the jurisdiction. Considering this, the subject of water supply and demand balance has been discussed further in context of administrative units.

District-wise and block-wise water balances have been carried out with an analysis of the results, to provide a forecast of water resources availability and accessibility in the future of the Rajasthan State.

The 33 districts of the Rajasthan State and their associated 249 blocks have been simulated with the integrated water-planning tool WEAP. In each simulation of the WEAP tool, the different types of demand within the domain are represented with demand nodes and the different water resources are represented with supply nodes. Transmission links connect between the demand nodes and the supply nodes allowing the transfer of water.

The different planning stages impact the non-agricultural water demand, their respective allocated water from dams, the on-farm and off-farm irrigation efficiency, the silt accumulated in dams and the integration of on-going dams. The different dependability levels impact the availability of surface water (in dams, diversion structures and canals) and the net crop water requirements.

The data was entered on a monthly basis in order to improve the estimation of the evaporation and spills from dams and thus of the annual water balance. Each year was simulated from June to May in order to begin the simulation with the filling of dams during the monsoon period.

The supply system is represented by links between nodes allowing the supply of water from a resource node to a demand node and in some cases from a resource node to another resource node (cases such as spills from a dam to another dam or diversion systems).

The parameters and their associated constraints used in the simulations for the different WEAP objects: demand nodes, water resource node, and links between nodes are given in Table 17.1.

Table 17.1: Objects and Parameters used in Simulation

Type of object	Object	Parameter	Unit
Demand node	Non-agricultural or agricultural demand node	Monthly water demand	Mm^3/yr
		Priority to be supplied	-
Water resource node	Groundwater node	Annual Recharge	Mm^3/yr
	Major/medium dam node	Monthly inflow	Mm^3/month
		Gross Storage Capacity	Mm^3
		Dead storage	Mm^3
		Volume-elevation Table	Mm^3-m
		Monthly evaporation rate	Mm/month
		Silt accumulation rate	$m^3/km^2/yr$
		Free Catchment Area	km^2
		Filling priority	-
	Minor structures node	Total storage capacity of minor dams	Mm^3
		Total water spread area of small water bodies	Km^2
		Assumed depth of small water bodies	m
		Monthly evaporation rate	mm/month
	Canal node	Annual inflow	Mm^3/yr
	Diversion node	Monthly inflow	Mm^3/month
	Intake node	Monthly inflow	Mm^3/month
Supply system	Link between nodes	Annual allocation for the destination node	Mm^3/month
		Supply priority	-
		Loss coefficient	%

The results of simulation enable the identification of block-wise and district-wise shortages and unutilized water. The analysis allows a discussion of potential improvements that can be made at a state and district management level to ensure an efficient use of the water resources. The main results of water supply and demand balance are given below.

17.4.1 Satisfaction of the Non-agricultural Demand

This category presents the present and future unmet demand of the domestic, livestock, wildlife, industrial and power plant uses. It points out which blocks in each district have shortages along with plans to fill gaps and associated estimated cost. The district-wise analysis is given in Table 17.2.

Table 17.2: Analysis of Supply Coverage of Non-agricultural Demand

S. No.	District	Supply coverage of the non-agricultural demand	Plans to fill gap with estimated cost
1	Ajmer	Although there is no non-agricultural unmet demand at present (year 2010), shortages will appear in the Peesangan block, where the Ajmer town is located, for future planning stages. Other smaller shortages will also occur from planning stage 2040 in Jawaja and Kishangarh blocks. The maximum non-agricultural unmet demand of the district is 60 Mm^3/yr.	It is proposed to transfer 300 Mm^3/yr water from Anas River in Mahi Basin to Berach River in Banas Basin to augment the Bisalpur Dam. The project also includes augmentation of Jaisamand Dam (Udaipur), Rajsamand Dam (Rajsamand) and Meja Dam (Bhilwara). The total estimated cost of the project is Rs. 3681.30 Crores.
2	Alwar	Although there is no non-agricultural unmet	It is proposed to transfer 21.16 Mm^3/yr

S. No.	District	Supply coverage of the non-agricultural demand	Plans to fill gap with estimated cost
		demand at present, small shortages appear in the Alwar town starting from planning stage 2040. The maximum non-agricultural unmet demand of the district is 19 Mm^3/yr.	water from Chambal River to augment the existing Jaisamand Bund (Alwar). The project also includes enroute requirement of Dhaulpur, Bharatpur and Alwar Districts. The total estimated cost of the project is Rs. 565.42 Crores.
3	Banswara	For all planning stages and dependability levels, there is no unmet demand for non-agricultural uses, except for the power plant in the Chhoti Sarvan block for a dependability level of 90% in 2060.	Inter-state agreement with Gujarat should be reviewed for additional utilization of water in Rajasthan from Mahi Bajaj Sagar Dam.
4	Baran	There is no non-agricultural unmet demand except for Kawai and Chhabra power plants in future planning stages.	These power plants future demands are to be met from proposed Parwan Major Irrigation Project. The estimated cost of Parwan Major Irrigation Project is Rs. 2271.10 Crores.
5	Barmer	There is currently a non-agricultural unmet demand in the majority of the blocks. This unmet demand reaches a maximum of about 104 Mm^3/yr for a dependability level of 90% in 2060.	The gaps will be fulfilled after completion of ongoing projects: 1) Barmer Lift Canal Water Supply Project Phase-I for providing drinking water supply to Barmer city, 412 villages of Barmer and 161 villages of Jaisalmer district from Indira Gandhi Main Canal with an estimated cost of Rs. 688.66 Crores, and 2) Pokaran Phalsoond Balotra Lift Water Supply Project for providing drinking water to Pokaran (in Jaisalmer district), Balotra and Siwana towns and 580 villages of Barmer and Jaisalmer districts from Indira Gandhi Main Canal with an estimated cost Rs.1444.20 Crores; and proposed project- Barmer Lift Project Phase-II to provide drinking water to 691 villages of Barmer district with an estimated cost of Rs. 797.75 Crores.
6	Bharatpur	There is no non-agricultural unmet demand, except for wildlife in the Keoladeo National Park.	There is an ongoing project to supply water to Keoladeo National Park from Goverdhan Drain, which will fill this gap. The estimated cost of the project is Rs. 56.04 Crores. Also, there is an ongoing project - Chambal Dhaulpur Bharatpur Water Supply Project - to supply water to 945 villages in Bharatpur district and 96 villages in Dhaulpur district apart from urban towns of Dhaulpur (partial), Bharatpur, Kumher, Deeg, Nagar and Kaman. The estimated cost of the project is Rs. 477.99 Crores. This project will further strengthen the water supply scenario in Bharatpur district.
7	Bhilwara	Shortages appear for future planning stages in the Suwana block, where the Bhilwara town is located. In addition, the demand of the planned power plant in Mandalgarh block	This gap shall be closed once the Chambal Bhilwara Water Supply Project is completed. The estimated cost of the project is Rs. 727.82 Crores. There is

S. No.	District	Supply coverage of the non-agricultural demand	Plans to fill gap with estimated cost
		cannot be satisfied for all dependability levels. Thus, the maximum non-agricultural unmet demand of the district is 65 Mm^3/yr or 35 Mm^3/yr depending if the planned power plant is considered or not.	another proposed project aimed at transferring 84.0 Mm^3/yr water from Anas River (Mahi basin) to Meja Dam (Bhilwara). The project also includes augmentation of Jaisamand Dam (Udaipur), Rajsamand Dam (Rajsamand) and Bisalpur Dam (Tonk). The total estimated cost of the project is Rs. 3681.30 Crores. This will further augment the water availability in Bhilwara district.
8	Bikaner	There is no non-agricultural unmet demand.	-
9	Bundi	There is no non-agricultural unmet demand.	-
10	Chittaurgarh	There is no domestic and livestock unmet demand but there are some shortages for the industry and power plant in the Chittaurgarh block.	There are gaps of small amount, which can be fulfilled with proper water management.
11	Churu	There is non-agricultural unmet demand in the Sujangarh block, starting from planning stage 2040. For a dependability level of 90% in 2060, it reaches an amount of about 10 Mm^3/yr, out of which 7 Mm^3/yr affect the domestic demand.	A project named Aapni Yojana Phase-II is under consideration to cover 444 villages of Churu district and Jhunjhunu district and 6 towns of Churu district from Sahwa Lift Canal which takes off from Indira Gandhi Main Canal as source with an estimated cost of Rs. 1330.00 Crores. The shortages will be fulfilled after completion of this scheme.
12	Dausa	There is no non-agricultural unmet demand.	-
13	Dhaulpur	There is no non-agricultural unmet demand.	Also, there is an ongoing project - Chambal Dhaulpur Bharatpur Water Supply Project - to supply water to 945 villages in Bharatpur district and 96 villages in Dhaulpur district apart from urban towns of Dhaulpur (partial), Bharatpur, Kumher, Deeg, Nagar and Kaman. The estimated cost of the project is Rs. 477.99 Crores. This project will further strengthen the water supply scenario in Bharatpur district.
14	Dungarpur	There is no non-agricultural unmet demand.	-
15	Ganganagar	There is no non-agricultural unmet demand.	-
16	Hanumangarh	There is no non-agricultural unmet demand.	-
17	Jaipur	The present shortage for Jaipur City will keep increasing to reach a maximum of 240 Mm^3/yr, 370 Mm^3/yr and 450 Mm^3/yr of unmet demand, in 2020, 2040 and 2060 respectively for a dependability level of 90%. At planning stage 2040 and 2060, shortages will even occur for a dependability level of 25% reaching an amount of 35 Mm^3/yr and 120 Mm^3/yr respectively. The maximum total unmet demand for non-agricultural uses in Jaipur district is about 680 Mm^3/yr.	There is a proposed project, Isarda Dam, on Banas River downstream of Bisalpur dam to cater for future water supply to Jaipur city. The proposed gross storage capacity of the dam is 305 Mm^3 and the estimated cost is Rs. 306 Crores. There is another proposed project aimed at transferring of surplus water from Mej River (Chambal basin) near Lakheri in Bundi district to the Ramgarh dam in Jaipur district and Isarda Dam in Tonk district and enroute dams. The proposal envisages pumping of 317.59 Mm^3/yr of flood water

S. No.	District	Supply coverage of the non-agricultural demand	Plans to fill gap with estimated cost
			from Mej River during the monsoon period into the Ramgarh Dam (28.0 Mm^3/yr), Isarda Dam (173.67 Mm^3/yr) and enroute dams. The estimated cost of project is Rs. 2137.86 Crores. It is also proposed to transfer 300 Mm^3/yr water from Anas River in Mahi Basin to Berach River in Banas Basin to augment the Bisalpur Dam. The project also includes augmentation of Jaisamand Dam (Udaipur), Rajsamand Dam (Rajsamand) and Meja Dam (Bhilwara). The total estimated cost of the project is Rs. 3681.30 Crores Hence, to meet the huge demand of Jaipur city in future, the above projects should be implemented on priority.
18	Jaisalmer	There is some non-agricultural unmet demand starting from planning stage 2040, which reaches an amount of about 11 Mm^3/yr for a dependability level of 90% in 2060 and which is mainly located in the Sankra block.	The gaps will be fulfilled after completion of ongoing projects: 1) Barmer Lift Canal Water Supply Project Phase-I for providing drinking water supply to Barmer city, 412 villages of Barmer and 161 villages of Jaisalmer district from Indira Gandhi Main Canal with an estimated cost of Rs. 688.66 Crores, and 2) Pokaran Phalsoond Balotra Lift Water Supply Project for providing drinking water to Pokaran (in Jaisalmer district), Balotra and Siwana towns and 580 villages of Barmer and Jaisalmer districts from Indira Gandhi Main Canal with an estimated cost Rs.1444.20 Crores.
19	Jalore	There is no non-agricultural unmet demand.	-
20	Jhalawar	There is no non-agricultural unmet demand, except for the Kalisindh power plant, which is only a planned power plant and can be met after completion of Kalisindh project.	Completion of Kalisindh project with an estimated cost of Rs. 1415.10 Crores
21	Jhunjhunu	There are no domestic shortages for any dependability level and planning stage but unmet demand appear in the industrial sector of Khetri and Jhunjhunun blocks for planning stage 2040 and 2060. The maximum non-agricultural unmet demand of the district is 20 Mm^3/yr.	A project named Aapni Yojana Phase-II is under consideration to cover 444 villages of Churu district and Jhunjhunu district and 6 towns of Churu district from Sahwa Lift Canal which takes off from Indira Gandhi Main Canal as source with an estimated cost of Rs. 1330.00 Crores. With this scheme and proper water management, additional water will be available for industrial sector.
22	Jodhpur	There is no non-agricultural unmet demand.	-
23	Karauli	There is no non-agricultural unmet demand.	There is an ongoing project to cover 926 villages and four towns of Sawai Madhopur and Karauli district with an estimated cost of Rs. 468.18 Crores. This will further strengthen the drinking water supply scenario in Karauli district.

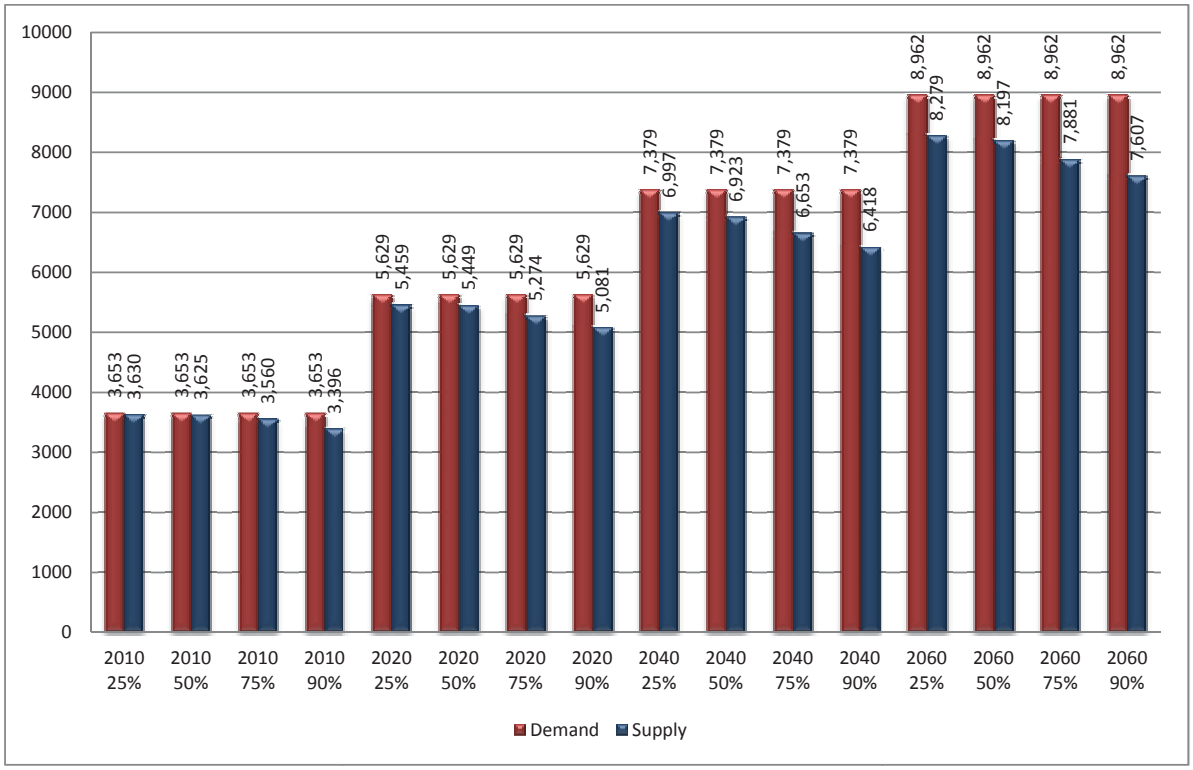
S. No.	District	Supply coverage of the non-agricultural demand	Plans to fill gap with estimated cost
24	Kota	There is no non-agricultural unmet demand.	-
25	Nagaur	There is no non-agricultural unmet demand.	There is an ongoing project - Nagaur Lift Water Supply Project for 5 towns and 502 villages of Nagaur district. The estimated cost of project is Rs. 761.00 Crores.
26	Pali	There is some non-agricultural unmet demand, mainly located in the Pali block but also in the Rohat block. The maximum non-agricultural unmet demand of the district reaches an amount of about 35 Mm^3/yr for a dependability level of 90% in 2060, out of which 25 Mm^3/yr for domestic use.	There is an ongoing project to save water losses in open canal from Jawai dam to provide safe drinking water to additional 531 villages and 10 towns of Pali district by converting the existing canal system into pipeline from Jawai dam with an estimated cost of Rs. 634.79 Crores. Thus the shortages can be fulfilled by conservation of water being lost in open canal flow through seepage, evaporation and pilferage.
27	Pratapgarh	There is no non-agricultural unmet demand.	-
28	Rajsamand	There are small shortages, located in Bhim, Railmagra and Rajsamand blocks. For planning stage 2020, small shortages of less than 3 Mm^3 appear in the industrial sector and then there is also an unmet demand as regards domestic and livestock uses. The maximum non-agricultural unmet demand of the district is 28 Mm^3/yr, out of which ~ 5 Mm^3/yr for domestic use.	There is a proposed project aimed at transferring 98.5 Mm^3/yr water from Anas River (Mahi basin) to Rajsamand Dam (Rajsamand). The project also includes augmentation of Jaisamand Dam (Udaipur), Meja Dam (Bhilwara) and Bisalpur Dam (Tonk). The total estimated cost of the project is Rs. 3681.30 Crores. This will further augment the water availability in Rajsamand district.
29	Sawai Madhopur	There is no major problem of shortages.	There is an ongoing project to cover 926 villages and four towns of Sawai Madhopur and Karauli district with an estimated cost of Rs. 468.18 Crores. This will further strengthen the drinking water supply scenario in Sawai Madhopur district.
30	Sikar	There are shortages in the Piprali block, where the Sikar town is located, for planning stage 2040 and 2060. The maximum non-agricultural unmet demand of the district is 28 Mm^3/yr.	There is a proposal, Fatehpur-Laxmangarh Project, to provide safe drinking water to the 3 towns (Fatehpur, Laxmangarh and Ramgarh) and 286 villages of Sikar district with IGNP as source. The estimated cost of the project is Rs. 832.00 Crores. To solve the shortage problem of Piprali block this proposal should include supply to Sikar town and villages of Piprali block also.
31	Sirohi	There is no non-agricultural unmet demand.	-
32	Tonk	There is no non-agricultural unmet demand.	-
33	Udaipur	There are shortages, mainly in the Girwa block, where the Udaipur City is located. The demand is entirely met only for a dependability level of 25% and 50% at present and for a dependability level of 25% in planning stage 2020. The maximum total unmet demand for non-agricultural uses in Udaipur district is 115 Mm^3/yr, out of which about 50 Mm^3/yr of domestic unmet demand in Udaipur City.	There is an ongoing project Dewas Stage-II which consists of construction of two dams (total storage capacity 10.97 Mm^3) near Akodra and Madri villages of Jhadol and Girwa tehsils, respectively of Udaipur district to augment drinking water supply to Udaipur city. The estimated cost of the project is Rs. 379.19 Crores. The Dewas Stage-III is proposed near village

S. No.	District	Supply coverage of the non-agricultural demand	Plans to fill gap with estimated cost
			Nathiyathal, under this a dam of 13.08 Mm^3 and a 11.05 km long tunnel is to be constructed. Near village Ambawa is proposed the last and fourth Stage of the project in which a dam with a capacity of 15.26 Mm^3 and a tunnel 4.30 km long will be built. The estimated cost of the project is Rs. 568.15 Crores. Also a proposed project aimed at transferring 140.05 Mm^3/yr water from Anas River (Mahi basin) to Jaisamand Dam (Udaipur). The project also includes augmentation of Rajsamand Dam (Rajsamand), Meja Dam (Bhilwara) and Bisalpur Dam (Tonk). The total estimated cost of the project is Rs. 3681.30 Crores. This will further augment the water availability in Udaipur district. There is another proposed project to transfer 131.93 Mm^3/yr water from Jakham Dam to Jaisamand Dam (Udaipur), which will further strengthen the water supply scenario in Udaipur district. The total estimated cost of project is Rs. 85.82 Crores.

Note: As per Final Report No. 4.6

From the State water balance, the total non-agricultural demand and supply in all the Rajasthan State have been compared for the different planning stages and dependability levels and are presented in Figure 17.1.

Figure 17.1: State Non-Agricultural Demand and Supply for Planning Stages 2010, 2020, 2040, 2060 and Dependability levels 25%, 50%, 75%, 90%, in Mm^3/yr



The total supply for non-agricultural demand of the Rajasthan State varies between approximately 3400 Mm^3/yr (in 2010 and for a dependability level of 90%) and 8280 Mm^3/yr (in 2060 for a dependability level of 25%).

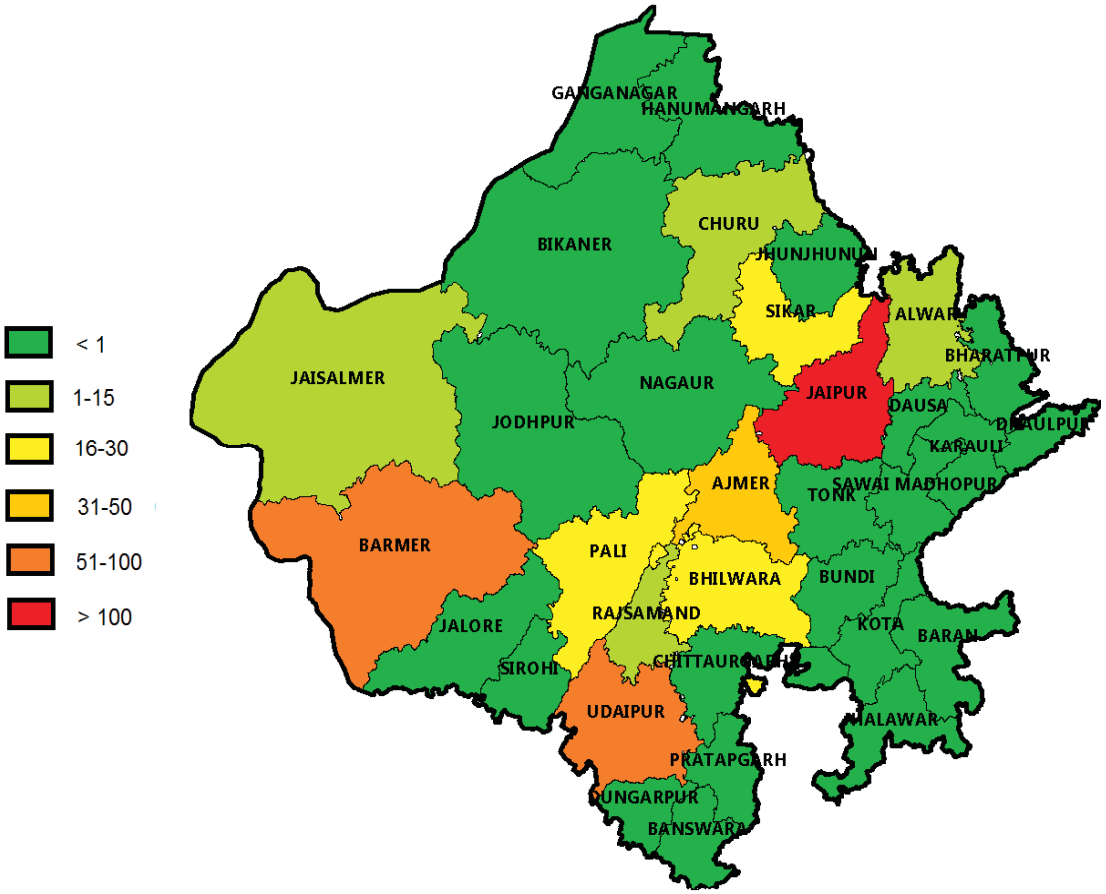
The total non-agricultural unmet demand of the Rajasthan State varies between approximately 25 Mm^3/yr (in 2010 and for a dependability level of 25%) and 1355 Mm^3/yr (in 2060 for a dependability level of 90%).

Therefore, the supply coverage of the non-agricultural demand varies between 85% and 99%.

Out of the Rajasthan total non-agricultural unmet demand, there is a total domestic unmet demand that varies between approximately 0 Mm^3/yr and 700 Mm^3/yr (in 2010 for a dependability level of 25% and in 2060 for a dependability level of 90%, respectively).

Out of this Rajasthan maximum domestic unmet demand of 700 Mm^3/yr, 64% is associated to the Jaipur City unmet demand (450 Mm^3/yr). The other districts having a domestic unmet demand in the more critical scenario (planning stage 2060 and dependability level of 90%) are Barmer, Udaipur, Ajmer, Pali, Bhilwara, Sikar, Alwar, Churu, Jaisalmer and Rajsamand. The range of the domestic unmet demand of each district for a dependability level of 90% and in 2060 is presented in Figure 17.2.

Figure 17.2: Total Domestic Unmet Demand per District for a Dependability level of 90% in 2060, in Mm^3/yr



17.4.2 Supply Coverage of the Irrigated Agricultural Demand

This category presents the minimum and maximum district-wise supply coverage of the agricultural demand over all dependability levels and planning stages inside CCA on one hand and outside CCA on another hand. The supply coverage inside CCA is expressed as a percentage that represents the part of the total of the district that can be fully exploited. The coverage outside CCA has been analyzed for coverage considering full potential cultivable area as well as considering maximum area irrigated outside CCA during past few years. The district-wise analysis is given below.

Table 17.3: Analysis of Supply Coverage of Irrigated Agricultural Demand

S. No.	District	Supply coverage of the Irrigated Agricultural Demand		
		Inside CCA of Surface Water Projects	Outside CCA of Surface Water Projects	
			Considering full potential cultivable area	Considering maximum area irrigated during past few years
1	Ajmer	6% to 94%	3% to 8%	27% to 70%
2	Alwar	20% to 90%	11% to 20%	15% to 27%
3	Banswara	24% to 100%	6% to 11%	52% to 95%
4	Baran	60% to 92%	20% to 23%	26% to 29%
5	Barmer	3% to 83%	< 3%	5% to 30%
6	Bharatpur	20% to 58%	14% to 22%	17% to 25%
7	Bhilwara	10% to 82%	5% to 8%	29% to 43%
8	Bikaner	34% to 100%	4% to 8%	25% to 48%
9	Bundi	39% to 96%	11% to 13%	17% to 21%
10	Chittaurgarh	15% to 83%	6% to 11%	14% to 25%
11	Churu	31% to 100%	< 4%	16% to 32%
12	Dausa	27% to 98%	9% to 18%	14% to 28%
13	Dhaulpur	45% to 92%	21% to 29%	32% to 44%
14	Dungarpur	33% to 100%	4% to 7%	33% to 57%
15	Ganganagar	54% to 100%	-	-
16	Hanumangarh	48% to 100%	-	-
17	Jaipur	16% to 76%	7% to 12%	17% to 31%
18	Jaisalmer	6% to 25%	< 2%	7% to 37%
19	Jalore	26% to 97%	7% to 11%	20% to 32%
20	Jhalawar	47% to 95%	17% to 19%	30% to 34%
21	Jhunjhunu	5% to 99%	4% to 9%	7% to 15%
22	Jodhpur	26% to 95%	5% to 9%	22% to 38%
23	Karauli	27% to 100%	22% to 29%	42% to 55%
24	Kota	54% to 95%	19% to 25%	25% to 37%
25	Nagaur	8% to 89%	5% to 9%	23% to 40%
26	Pali	6% to 73%	< 5%	21% to 36%
27	Pratapgarh	25% to 94%	10% to 11%	27% to 32%
28	Rajsamand	1% to 47%	< 5%	7% to 34%
29	Sawai Madhopur	26% to 89%	16% to 20%	26% to 33%
30	Sikar	7% to 68%	3% to 9%	8% to 20%
31	Sirohi	13% to 84%	10% to 16%	32% to 48%
32	Tonk	20% to 96%	12% to 15%	34% to 42%
33	Udaipur	10% to 71%	2% to 7%	11% to 41%

Note: As per Final Report No. 4.6

From the State water balance, the total agricultural demand and supply inside CCA and outside CCA in all the Rajasthan State have been compared for the different planning stages and dependability levels. As regards the agricultural demand outside CCA, it has been calculated in two ways: considering full potential and considering the maximum irrigated areas in the past decade (2002-2010). The results are presented in Figure 17.3, 17.4 and 17.5.

Figure 17.3: State Agricultural Demand and Supply Inside CCA for Planning Stages 2010, 2020, 2040, 2060 and Dependability levels 25%, 50%, 75%, 90%, in Mm³/yr

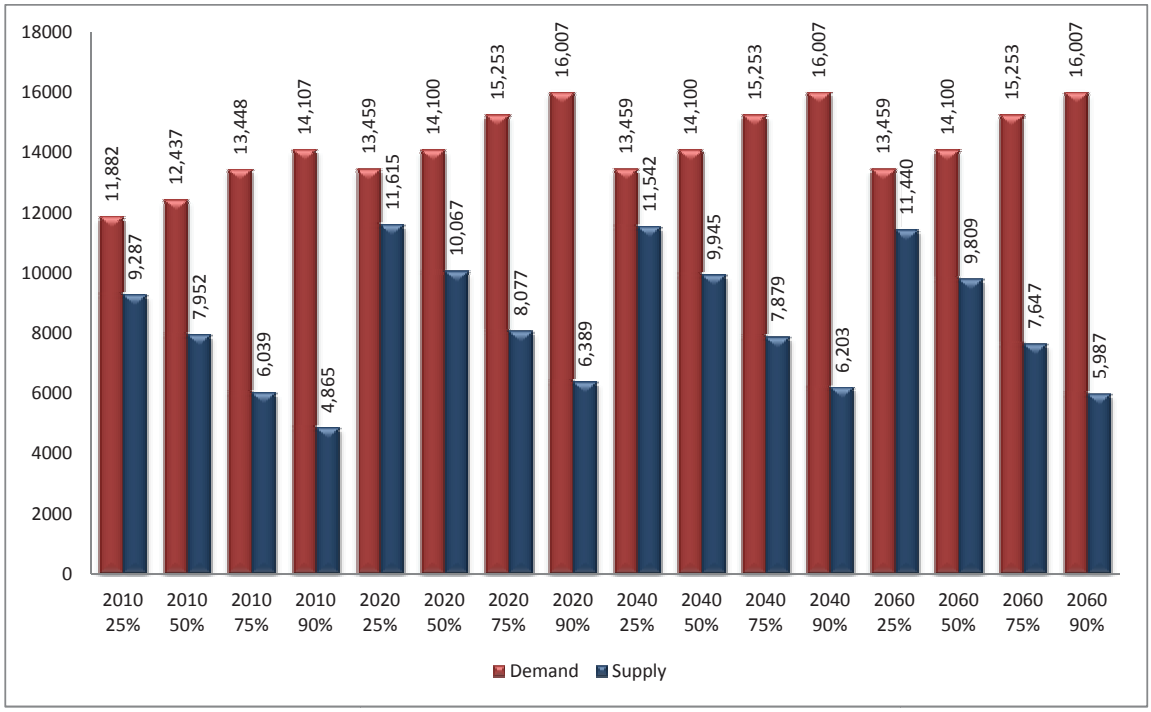


Figure 17.4: State Agricultural Demand and Supply Outside CCA for Planning Stages 2010, 2020, 2040, 2060 and Dependability levels 25%, 50%, 75%, 90% and Considering Full Potential in Mm³/yr

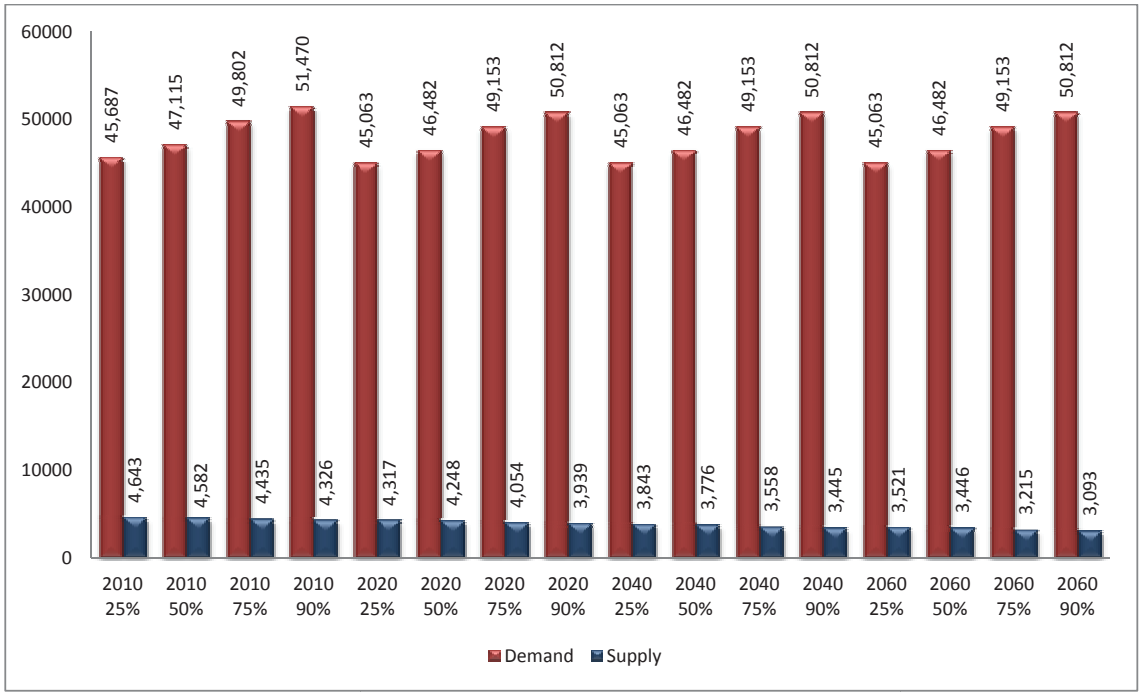
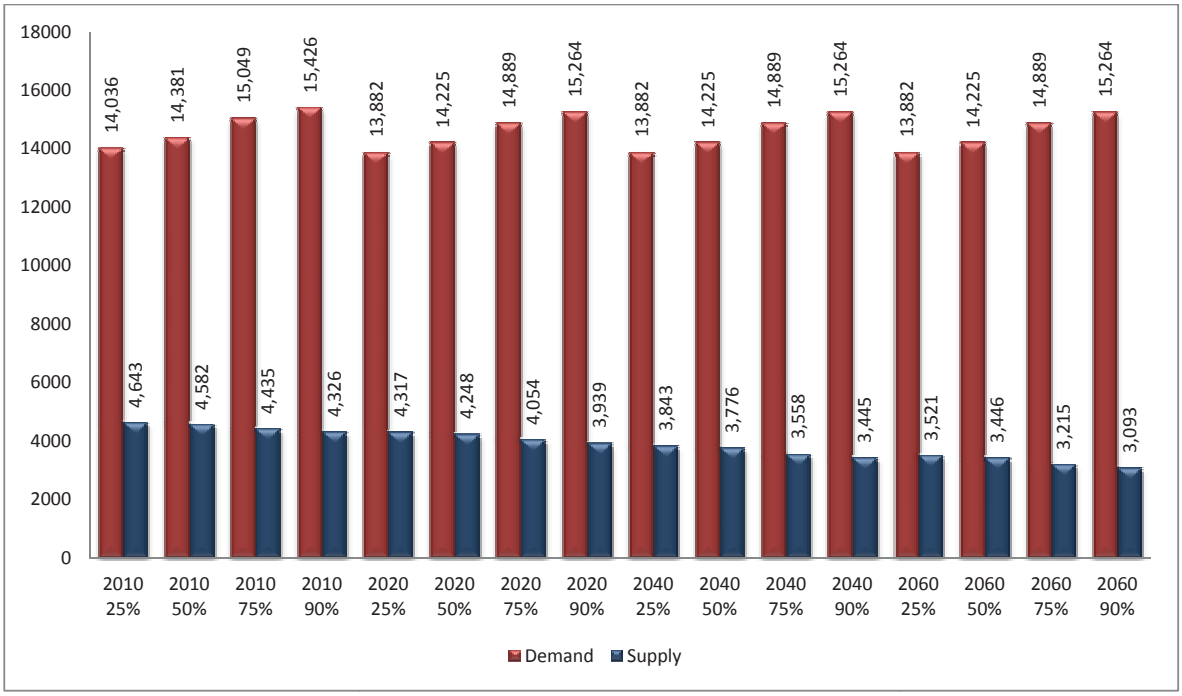


Figure 17.5: State Agricultural Demand and Supply Outside CCA for Planning Stages 2010, 2020, 2040, 2060 and Dependability levels 25%, 50%, 75%, 90% and Considering Maximum Irrigated Areas in Past Decade (2002-2010), in Mm³/yr



Inside CCA, the total supply for agricultural demand of the Rajasthan State varies between approximately 4865 Mm^3/yr (in 2010 and for a dependability level of 90%) and 11615 Mm^3/yr (in 2020 for a dependability level of 25%), which represents a supply coverage of 34% and 86%, respectively (Figure 17.2).

Outside CCA, the total supply for agricultural demand of the Rajasthan State varies between approximately 3090 Mm^3/yr (in 2060 and for a dependability level of 90%) and 4640 Mm^3/yr (in 2010 for a dependability level of 25%). Considering full potential, it represents a supply coverage of 6% and 10% respectively. Considering maximum irrigated areas in past decades (2002-2010), it represents a supply coverage of 20% and 33%, respectively (Figures 17.3 and 17.4).

To fill the gaps mainly for the domestic water supply and other non-agricultural water demands in future timely completion of some ongoing projects and implementation of some proposed plans/projects by Government of Rajasthan and some additional ones by the Consultants after further detailed studies is considered essential. These plans/projects are enlisted in Action Plan given in Chapter 18.

18. Conclusions and Recommendations

18.1 General

During the course of Study on Planning of Water Resources of Rajasthan State the Consultant has prepared and submitted following Reports on various aspects of the Study:

One Inception Report
Seven Preliminary Reports
Eight Draft Final Reports
Nine Final Reports (including this report)
One Report on Training

The various aspects covered under Nine Final Reports depicted by its title are as follows:

Final Report No.	Title
4.1	Agroclimatic zone-wise Hydrology and Weather
4.2	Basin / Sub- basin-wise Surface and Groundwater availability
4.3	Detailed Study on catchment areas
4.4	Groundwater study by Agroclimatic Zones
4.5	Water Pollution
4.6	Water Supply and demand by Districts
4.7	Identification of new projects in water surplus basins
4.8	Identification of projects to be rehabilitated
4.9	Comprehensive full scale integrated plan for the State as a whole

Each Final Report (4.1 to 4.8) has been prepared in detailed manner with supporting data and includes specific Conclusions and Recommendations related to the subject matter covered in them. Further, each report includes an Action Plan based on Recommendations: enlisting Recommendation, Proposed Actions, Anticipated Value Addition and Responsible Department for taking action.

18.2 Action Plan Based on Recommendations

A combined Action Plan based on Recommendations given in the Eight Final Reports on various aspects covered under the Study on Planning of Water Resources of Rajasthan State is given in Table 18.1 for further necessary action by the responsible Department.

Table 18.1: Action Plan based on Recommendations

S. No.	Recommendations	Proposed Actions	Estimated Cost, Million Rs. (at 2010 price level)	Anticipated Value Addition	Responsibility
A. Hydro-meteorological Aspects					
1	Installation of new Rain - Gauge stations	It is proposed to install 103 nos. new Rain Gauge stations, and upgrade/rehabilitate 13 nos. existing Rain Gauge stations. Out of 103 nos. new Rain Gauge stations (8+21) 29 nos. are self recording and 74 nos. are Non-self recoding. 13 nos. existing Rain Gauge stations are also self recording, which are proposed for upgradation or rehabilitation. **(for details refer Table 18.1,18.2 and 18.3 of Volume 1 of Final Report No. 4.1)**	16.14	To increase the density of rain gauge sites in areas where the present density is low, while also considering their proximity to villages or towns, from where the observator can conveniently access the rain gauge stations.	SWRPD and WRD
2	Installation of new Dam Observation Stations	It is proposed to install water level recorders at 83 dams and canals, covering 12 river basins. On dams two types of water level recorder (WLR), i.e. Shaft Encoder type and Bubbler type WLRs are proposed. At each location Automatic Weather Station (AWS) is also proposed. **(for details refer Table 18.5 of Volume 1 of Final Report No. 4.1)**	87.18	Proper accounting of inflows.	SWRPD and WRD
3	Installation of new River Gauge & Discharge (G&D) sites	It is proposed to install 53 (19 + 34) new River Gauge & Discharge (G&D) sites in various basins/sub-basins. **(for details refer Table 18.4 of Volume 1 of Final Report No. 4.1 and Table 11.1-1 of Volume 1 of Final Report No. 4.2)** Out of the 34 new sites proposed, 21 sites can be taken up on first priority, than another 10 sites on second priority and remaining 3 sites on third priority. **(for details of priority refer Table 11.1-2 of Volume 1 of Final Report No. 4.2)**	28.49	Better accounting of surface water flow in rivers and improvement in available database.	SWRPD and WRD

S. No.	Recommendations	Proposed Actions	Estimated Cost, Million Rs. (at 2010 price level)	Anticipated Value Addition	Responsibility
4	Improvement in existing River Gauge & Discharge (G&D) sites	Considering the present status of existing River Gauge & Discharge sites, various actions are proposed to improve the existing condition of site like update the cross-section data, replacement of instruments, etc. **(for details refer Table 11.1-3 of Volume 1 of Final Report No. 4.2)**	3.27	Improvement in accuracy and reliability of observed data.	SWRPD, WRD and Central Water Commission
5	Suitability of new G&D site location	The tentative locations of new G&D sites have been given, however, following points may be kept in mind before selecting the location: • The cross section of the stream needs to be fixed and known. When the system is installed e.g. under a bridge (having fixed concrete side walls), it is easy to calculate the cross section for different water levels. Therefore installation near or on/under such a fixed structure (bridge, lock, etc.) has great advantages. • The section of the river/stream where measurements are to take place should be **preferably straight** approximately 50 m before the measuring point (this to make the flow as uniform as possible). • There should be no major **boulders or large objects** upstream of measurement location (same reason as above). • There should be no **aquatic growth** at the measurement location. • The stream should **not overflow** its banks for any water level. • The stream section should **not be too wide** because for a very wide section we could only measure the highest flows. The river cross-section at gauging site should be stable.	-	Proper site location.	SWRPD and WRD

S. No.	Recommendations	Proposed Actions	Estimated Cost, Million Rs. (at 2010 price level)	Anticipated Value Addition	Responsibility
		• **Protected site;** when the location where the system is protected against theft or damage (by people or animals) this is preferred.			
6	Data measurement and storage	The following is proposed for proper data management and storage: • River cross-sections details where G&D site is installed should be measured and updated atleast once in 5 years. This will reduce the error in measuring the stream flow to a large extent. • Discharge rating curve should be generated/updated for all gauging sites to assess the volume of water passed through a particular site. • All defunct and faulty instruments may be either replaced or upgraded. • Measurements may be taken at regular interval and stored in standardized digital data formats. This data be digitized, quality checked and stored in electronic form at a central place. • If an existing gauge site has unstable cross-section it may be shifted to nearby location with stable cross-section.	-	Improved database and reliability of data.	SWRPD and WRD
Sub-Total			**135.08**		
B. Existing Major and Medium Projects					
1	Monitoring of Project catchments	• The WHS should only be constructed in catchments of existing projects where the yield is surplus, that too after considering its effect on downstream dam. • The encroachments on river beds should be checked. • Any sort of development in the catchment should be monitored and checked such as illegal groundwater	-	To ensure integrated and sustainable water resources development across scales.	SWRPD and WRD

S. No.	Recommendations	Proposed Actions	Estimated Cost, Million Rs. (at 2010 price level)	Anticipated Value Addition	Responsibility
		extraction, change in cropping intensity, number of additional WHS constructed, etc.			
2	Proper recording of Reservoir operation data	• Reservoir operation data like date of release of water, its quantity etc should be monitored and data should be securitized and stored electronically for easy access and use. • Volume of water spilled should be properly measured. • There should be a mechanism to accurately measure inflow to the dams by proper water accounting or by installing a discharge site. A standardized format should be developed to keep record of all water balance components (inflow, releases, spills, evaporation etc.) at reservoir as it is monitored and stored in projects like Jakham Dam, Kota Barrage, Jawahar Sagar Dam etc. • Evaporation at each reservoir site should be measured by installing Evaporation pan. • Gauge-Capacity curve for the reservoir should be updated.	-	Better planning and management of surface water resources	SWRPD and WRD
Sub-Total			**-**		
C. Groundwater					
1	Monitor groundwater levels, groundwater quality and groundwater development in the State	• Observe the groundwater levels and groundwater quality on regular basis (4 times in a year) with groundwater monitoring network and study their trend. **(for details refer Section 1.10 and 1.12.3 of each ACZ analysis in Volume 2 of Final Report No.4.4)** • The assessment to monitor the ground water development and use is done at an interval of 4	-	Improved accuracy and surveillance of groundwater levels and groundwater quality. Controlled use of annually available groundwater.	SWRPD and RGWD

S. No.	Recommendations	Proposed Actions	Estimated Cost, Million Rs. (at 2010 price level)	Anticipated Value Addition	Responsibility
		years. It would be desirable if assessments are also made regularly on annual basis also for controlled use of annually available groundwater. **(for details refer Section 4.8 and 4.9 of Volume 1 of Final Report No. 4.4)**			
2	Improve the database of specific yield for the benefit of refining estimates of dynamic groundwater recharge	Execute a field survey for conducting pumping tests on wells in each district. Also to conduct pumping tests on every new piezometer being installed.	-	Improved accuracy of groundwater assessment.	SWRPD and RGWD
3	Examine additional methods for evaluating groundwater recharge	Chloride mass balance and Chlorine-36 isotope methods for estimating long-term average rates of deep percolation may be experimented as alternative method. A two year study to test applicability of two methods at two different sites may be desirable. Such methods are ideal for arid and desert areas.		Alternative method of evaluating groundwater recharge. Present practices being adopted can be compared and cross-checked.	SWRPD and RGWD
4	Improvement of Groundwater monitoring network	• Additional 2745 monitoring wells should be installed and the existing 1351 duplicate ones or very close ones should be closed based on the recommendations of the optimization study of groundwater monitoring network in the report. **(for details refer Volume 4 of Final Report No. 4.4)** • Out of the existing 3518 dug wells considered under optimization study, 827 are proposed to be excluded from groundwater monitoring network, hence there is a need to replace the remaining 2691 dug well monitoring stations with piezometers. **(for details refer Volume 4 of Final Report No. 4.4)** • As per the water table decline trend **(for details refer Section 1.10 of each ACZ analysis in Volume 2 of Final Report No. 4.4)**, 128, 124 and	823.50 807.30	Improved accuracy and reduction in data collection.	SWRPD and RGWD

S. No.	Recommendations	Proposed Actions	Estimated Cost, Million Rs. (at 2010 price level)	Anticipated Value Addition	Responsibility
		44 piezometers are likely to go dry in 2020, 2040 and 2060, which shall need replacement in future.			
5	Monitor the presence of pesticides in the groundwater in areas of intensive agriculture/command areas activity, especially in locations faced with problems of high nitrate levels	• Undertake well planned/designed studies towards assessment of non-point source contamination of alluvial aquifer systems to begin with in areas where increasing trends of nitrate levels are observed. Setting up key monitoring wells exclusively for monitoring and surveillance of pesticides in groundwater, as well as monitoring the increasing trends of nitrates and fluoride level in groundwater of various aquifers. • Design specific studies to determine the effects of land uses on groundwater quality. Suggested sites can include: (a) Urban storm water disposal and the other (b) Over cultivation areas associated with application of fertilizers and pesticides. **(for details refer Section 1.12.3 of each ACZ analysis in Volume 2 of Final Report No. 4.4)**	-	Prevention of further deterioration of groundwater quality due to application of fertilizers and pesticides, resulting in improvement in groundwater quality in long-term.	SWRPD and RGWD
6	Conduct new exploratory drilling	• Exploratory drilling in the areas/locations as recommended in Final Report No. 4.4 • Exploratory drilling of deep aquifers • Pumping test should be made mandatory for every newly drilled well in the State **(for details refer Section 11 of Volume 1 of Final Report No. 4.4)**	48.50	Improvement in data on aquifer boundaries, aquifer properties and depth to basement; and identification of new aquifers.	SWRPD, RGWD and Central Ground Water Board
7	Outflow of groundwater resources	Conservation / exploitation of groundwater flowing to adjoining country. **(for details refer Section 8.2 of Volume 1 of Final Report No. 4.4)**	-	Proper utilization of State's groundwater resources.	SWRPD, RGWD and WRD
8	Restructuring and capacity building of Groundwater Department	• Conduct study on restructuring and capacity building	-	Improvement in overall working of RGWD.	SWRPD, RGWD and GoR

S. No.	Recommendations	Proposed Actions	Estimated Cost, Million Rs. (at 2010 price level)	Anticipated Value Addition	Responsibility
		of Groundwater Department, involving institutional capacity building, infrastructure capacity building and professional capacity building. • Creation of GIS Cell • Creation of Recharge Cell • Creation of Legal Cell			
9	Better understanding, higher awareness and sustainable development of the groundwater resources by the farmers	Develop outreach and translate the dynamics of groundwater to farmers, group of farmers & WUAs to create understanding, awareness and sustainable development of the groundwater resources.	-	Enhancement in understanding, awareness and sustainable development of groundwater resources by farmers.	SWRPD and RGWD
10	Adopt on-farm water management (OFWM) practices	State should make use of Resource Conservation Technologies such as laser land leveling, ditch and furrow methods of irrigation using tensiometer for affecting crop-water use, on-farm pond development including crop-diversification through micro-irrigation based system particularly in over-exploited and critical blocks with a view to developing water use efficiencies. **(for details refer Section 1.16.1 of each ACZ analysis in Volume 2 of Final Report No. 4.4)**	-	Improvement in water use efficiency ultimately resulting in reduction in groundwater exploitation and groundwater level stabilization.	SWRPD, RGWD and Rajasthan Agriculture Department
11	Control on illegal drilling of wells and control on groundwater exploitation	• Registration of rigs to control illegal drilling of wells. • To frame a Groundwater Act to control the exploitation of groundwater.	-	Control on groundwater exploitation resulting in stabilization of groundwater level.	SWRPD, RGWD and GoR
12	Data upgradation	Creation of an online system of various groundwater data entry at district level linked with the GIS Cell for an upgraded and updated data bank.	-	Upgraded and updated data bank with ease to access.	SWRPD and RGWD
13	Improve, detailed and frequent monitoring of stressed aquifer systems	• Set-up key observation-wells in stressed aquifers where stage of ground water abstraction is much higher than dynamic annual groundwater availability. • Installation of 1197 digital automatic water level	179.55	Control on groundwater exploitation in stressed aquifers.	SWRPD and RGWD

S. No.	Recommendations	Proposed Actions	Estimated Cost, Million Rs. (at 2010 price level)	Anticipated Value Addition	Responsibility
		recorder as well as water quality monitoring system in a phased manner to enable obtaining continuous & real- time record of levels and water quality. • At least 5 key wells need to be installed on each of the 19 mapped major aquifer units in the state, to begin with. **(for details refer Volume 4 of Final Report No. 4.4)**			
14	Promote Resource Conservation and Managed Aquifer Recharging measures towards improving water availability	• The proposed Recharge Cell under RGWD as one of its wing to discharge intended recharging work/ operation on continuing basis. • Designating ground water conservation areas (GCAs) in over- stressed aquifers where area-specific and design specific recharging measures be employed keeping in view the climatic-geomorphological and topographic set-up • Percolation ponds with recharge shafts • Recharging ephemeral stream bed areas through construction of cascading barriers and check dams • Promoting and upscaling farmers dug well recharge programme as well as arresting run-off at Aravalli Ridge-toe areas through specially dug lengthy stretches of trenches back-filled with boulders & gravels • Recharge shafts and roof top rain water harvesting measures to augment local ground water in Urban and Institutional areas. • Managed Aquifer Recharge programme may take benefit and develop convergence with Revised Master Plan for Recharging Ground Water (2013)	-	Enhanced groundwater availability and stabilization of ground water levels and improvement in groundwater quality.	SWRPD and RGWD

S. No.	Recommendations	Proposed Actions	Estimated Cost, Million Rs. (at 2010 price level)	Anticipated Value Addition	Responsibility
		prepared by CGWB, in which the areas feasible for recharge and types of structures to be constructed are given for consideration and implementation by State Government of Rajasthan			
15	Reduction of groundwater demand in over-exploited areas	Use of modern irrigation practices and technologies (pressurized irrigation) to reduce groundwater extraction for which subsidies are provided by GoR and irrigation during hours of low potential evaporation.	-	Reduction in over-exploitation resulting in stabilization of groundwater levels.	SWRPD, RGWD and Rajasthan Agriculture Department
16	Use of Fresh Static resources as contingency measures only	• Static resource (fresh) should not be mined but used only as contingency measures to be pressed into service and use only during drought periods • It is suggested if some groundwater sanctuary High Production wells could be constructed as regimes for supply in periods of distress & dire scarcity to serve as "Groundwater Sanctuary Parks"	-	Reduction in over-exploitation of groundwater and better management during situation of scarcity.	SWRPD and RGWD
17	Improve Quality of water supply to villages having non-potable water and link them to surface water schemes	A time based priority program to provide safe-drinking water based on principles of scientific source locations and well construction in convergence with Ministry of Drinking Water and Supply, Government of India, shall help improve the health and hygiene status of people inhabiting such areas.	-	Improvement in health and hygiene status of people in identified areas.	SWRPD, RGWD and PHED
18	Utilization of saline groundwater	• Drinking water stations for livestock should be raised based on tube well water supply from marginally saline groundwater resource areas. • Desalination and appropriate use of brackish water can be considered with donor assistance under bilateral corporation programme • Conduct experiments for developing use of brackish/saline groundwater for raising salt-tolerant crops where huge quantities of saline groundwater resides in shallow and deep aquifer systems	-	Utilization of saline groundwater resulting in reduced demand from fresh groundwater aquifers.	SWRPD, RGWD and Rajasthan Agriculture Department

S. No.	Recommendations	Proposed Actions	Estimated Cost, Million Rs. (at 2010 price level)	Anticipated Value Addition	Responsibility
19	Execute a programme on Repair, Renovation and Restoration of all village ponds & tanks	To be taken up on a time-bound programme which may have convergence with MNREGA and RKVY Scheme of Ministry of Agriculture, Government of India including desilting of ponds and or constructing recharge shafts around such ponds particularly at intake points to help recharge groundwater locally.	-	Enhanced recharge of groundwater.	SWRPD, RGWD and Rajasthan Rural Development & Panchayati Raj Department
20	Utilization of urban storm water	Arresting of Urban run-off and its use for horticulture, other non-drinking water uses and groundwater recharge is proposed based on "Modular Rain Water Tank Technology" which can capture huge quantity of Urban-run-off/ highway- run-off.	-	Enhanced recharge of groundwater and reduced demand of groundwater.	SWRPD, RGWD and Urban Local Bodies
Sub-Total			**1,858.85**		
D. Water Pollution					
1	Reduce Domestic Pollution in Urban and Rural areas	**Urban** • Establishment of sewage collection and treatment facilities in all the Class-I cities and Class-II towns, and subsequently in the lower category of the towns in the State, with adequate resources available for effective O&M • New Residential Developments to have their own fully functional sewage treatment systems and recycling and reuse systems • Building byelaws to be amended and made mandatory for new townships, flat schemes, colonies for opting dual piping system for flushing from treated wastewater • Watering of parks and gardens should be done by treated sewage water and surplus, if any, to be used for irrigation • Development of guidelines and regulation for	14,010.0 (for 2010) + 4,870.00 (additional for 2020) + 7,810.00 (additional for 2040) + 5,480.00 (additional for 2060) Note: Treatment cost only at present value.	Reduction in domestic pollution and reuse of treated sewage resulting in additional source of water.	SWRPD and Urban Local Bodies

S. No.	Recommendations	Proposed Actions	Estimated Cost, Million Rs. (at 2010 price level)	Anticipated Value Addition	Responsibility
		septage management **Rural** • Sanitation in rural areas to prevent pollution of small waterbodies, Tubewell, Handpumps, etc.			SWRPD and Rajasthan Rural Development & Panchayati Raj Department
2	Reduce Industrial Pollution	• Establishment of Effluent collection and treatment facilities in all large and medium industries and CETPs for clusters of small scale industries in the State, with adequate resources available for effective O&M **Large Scale Industries** • Concept of '0' outflow should be strictly followed • Treatment of effluent should be mandatory • Recycling of treated effluent **Small Scale Industries** • All the small scale industries in clusters to be shifted to identified industrial areas • All the small scale industries in residential areas to be shifted to identified industrial areas • All such industries should be connected to Common Effluent Treatment Plants	-	Reduction in industrial pollution and reuse of treated effluent resulting in additional source of water.	SWRPD, Rajasthan Department of Industries and Urban Local Bodies
3	Reduce Pollution from Non-point Sources	• Establishment of adequate and effective toilets for urban / rural poor • Establishment of effective garbage collection, transport, treatment and disposal facilities in all the Class-I cities and Class-II towns, and subsequently in the lower category of the towns in the State, with adequate resources available for effective O&M	-	Reduction in pollution from Non-point sources and improvement in solid waste, biomedical waste and hazardous waste management.	SWRPD, Urban Local Bodies and Rajasthan Rural Development & Panchayati Raj Department

S. No.	Recommendations	Proposed Actions	Estimated Cost, Million Rs. (at 2010 price level)	Anticipated Value Addition	Responsibility
		• Effective biomedical wastes and hazardous waste collection and disposal • Reduce agriculture pollution from Fertilizers/ Pesticides • Promotion of Organic Farming			SWRPD and Rajasthan Agriculture Department
4	Ensure Clean Water in the rivers and their Tributaries	• Establish a network of water quality monitoring • Establish online monitoring on important rivers	-	Improvement in water quality monitoring and enhanced data base.	SWRPD, Rajasthan State Pollution Control Board, Central Water Commission and WRD
5	Ensure environmental flows in the rivers, their tributaries and lakes/wetlands	Water resources augmentation in the different rivers and lakes/wetlands including various measures of water conservation in agriculture, domestic and industrial use, rainwater harvesting, reuse of wastewater	-	Improvement in ecological balance.	SWRPD and WRD
6	Ensure ecological integrity of the rivers, their tributaries and lakes/wetlands	Establish a sound scientific network of ecological assessment of rivers and lakes/wetlands health in the State including structural and functional components of ecosystem	-	Monitoring of ecological balance.	SWRPD and Rajasthan State Pollution Control Board
7	Monitoring of Water Pollution and functioning of various treatment systems	• Regular monitoring of compliance of norms • Vigilance monitoring of compliance of norms	-	Regular monitoring will improve operation and maintenance of various treatment systems.	SWRPD, Rajasthan State Pollution Control Board, RGWD, and WRD SWRPD, Central Pollution Control Board and Central Ground Water Board
Sub-Total			**32,170.00**		

S. No.	Recommendations	Proposed Actions	Estimated Cost, Million Rs. (at 2010 price level)	Anticipated Value Addition	Responsibility
E. Improvement Plans					
1	Rehabilitation of 25 Major / Medium Irrigation Projects listed below: Arwar, Bassi, Bilas, Chandrabhaga, Chandsain, Dheel, Dindoli, Dugari, Galwania, Jaisamand (Udaipur), Jakham, Kalisil, Khari, Kothari, Lassadia, Madhosagar, Mahi Bajaj Sagar, Mataji Ka Khera, Meja, Murlia, Rajsamand, Sardar Samand, Ummed Sagar, Vallabhnagar, Wagan	Preparation of Detailed Project Reports for Rehabilitation of the listed 25 Major / Medium projects on priority. **(for details refer Section 9 of Final Report No. 4.8 and Section 15.4 of this report)**	2,867.39	Improvement in irrigation efficiency, resulting in increased crop production.	SWRPD and WRD
2	Improvement in Reservoir operation database and measurement of evaporation losses.	Regular records of storages, water drawls for irrigation, crop grown in command areas, evaporation, seepage losses and spillage should be kept. In all the projects losses through evaporation should be measured regularly.	-	Updated database and proper records of reservoir operation for better water accounting.	SWRPD and WRD
3	Reservoirs should be resurveyed to assure latest area-capacity at various levels in order to consider the impact of siltation in reservoirs.	The elevation-area-capacity curves of reservoirs are not updated and may give wrong information on water availability, hence the reservoirs for Major / Medium dams should be resurveyed through latest techniques (like sonar survey) and the updated elevation-area-capacity curves / tables should be prepared and in future should be updated periodically.	-	Impact of siltation in reservoirs and corrected present capacity.	SWRPD and WRD
4	Formation of Water Users Associations.	WUAs (Water Users Associations) should be formed in all projects and encouraged to be actively involved in water allocation and distribution as well as proper outlets should be designed in order to ensure equity in respect of head, middle and tail reaches.	-	Equitable distribution of water, ownership resulting in improvement in operation and maintenance.	SWRPD and WRD
5	Promotion of Night irrigation to reduce field losses through evaporation	Night irrigation should be promoted to assure saving on operational loses below the outlets and improve	-	Reduction in on-farm losses through evaporation	SWRPD and WRD

S. No.	Recommendations	Proposed Actions	Estimated Cost, Million Rs. (at 2010 price level)	Anticipated Value Addition	Responsibility
		upon field efficiency.			
6	Lining of field channels	Lining of field channels through WUAs. If conversion to pressurized irrigation is opted then lining of field channels is not required.	-	Better operation and maintenance due to ownership and reduction in seepage looses, resulting in less waterlogging along the canals and in the field.	SWRPD, WRD and WUAs
7	Conjunctive use of water	Conjunctive use of water especially in command areas where water logging is observed and likely to occur. Also pressurized irrigation should be promoted in such areas.	-	Improved water availability and reliability; reduction in water logging and consequently soil salinity.	SWRPD and WRD
8	Adoption of modern irrigation techniques	Looking at the scarcity of water and reduced inflows to dams, it is recommended to adopt modern irrigation techniques i.e. conversion from flood irrigation to pressurized irrigation in existing as well as new projects and also in groundwater irrigated areas to control over-exploitation. For surface water irrigated areas, conversion from flood irrigation to pressurized irrigation will result in increase in irrigated area. However, the areas irrigated by groundwater should not be increased, so that it will reduce the groundwater pumping and will stabilize the ground water levels in long term. GoR is also promoting pressurized irrigation and providing subsidy for it. A combined subsidy of 50% is provided by the Central and State Governments (Central: 40%, State: 10%) for sprinkler and drip irrigation systems. The Government of Rajasthan has taken an initiative to provide 20% additional subsidy for drip irrigation system.	-	Improved irrigation efficiency and crop yield.	SWRPD, WRD, RGWD and Rajasthan Agriculture Department
Sub-Total			**2,867.39**		

S. No.	Recommendations	Proposed Actions	Estimated Cost, Million Rs. (at 2010 price level)	Anticipated Value Addition	Responsibility
F. Development Plans					
1	Implementation of proposed projects.	• Preparation of Detailed Project Reports (DPR) of the 33 proposed projects listed in **Table 16.2, Section 16.4.3 of this report.** **(for details refer Section 7 of Final Report No. 4.7)** The proposed projects include Major/ Medium/ Minor storage projects, inter-basin transfer projects and artificial recharge projects. Also, most of the proposed projects consider component of drinking water demand of nearby town and villages. • Implementation of these proposed projects after approval of respective DPRs.	125,212.60	• New projects for utilisation of surplus water which considers drinking water requirements of scarcity areas. • Development of new irrigated areas. • Development of multi-purpose projects which cater for drinking water, power generation, irrigation and wild life demands.	SWRPD, WRD and PHED
2	Catchment Treatment to reduce sedimentation of reservoirs and increase inflows	The life span of a reservoir is greatly reduced due to erosion in the catchment area. Adequate preventive measures are thus needed for the treatment of catchment of reservoirs for its stabilization against future erosion including proper cross-drainage etc.	-	Reduction in reservoir sedimentation resulting in less effect on water availability in reservoirs in future.	SWRPD, WRD and Watershed Development & Soil Conservation Department
3	Watershed Development	Integrated use, regulation and development of water and land resources of each watershed with emphasis on soil and water conservation.	-	Sustainable use of land and water for the benefit of its dependents.	SWRPD, WRD and Watershed Development & Soil Conservation Department
4	Holistic approach in water resources planning and management	At present, there is no holistic approach and each department of Rajasthan is working without taking into account concern of other relevant department on various water related issues. There should be one department for planning i.e. SWRPD. Restructuring of	-	Integrated water resources planning and management.	SWRPD, RGWD, other related Departments and GoR

S. No.	Recommendations	Proposed Actions	Estimated Cost, Million Rs. (at 2010 price level)	Anticipated Value Addition	Responsibility
		SWRPD and RGWD is a must to meet the future challenges, which is necessary to implement state water policy action plan, community participation, proper data collection, enforcing legal issues, etc.			
Sub-Total			**125,212.60**		
G. Specific Plans/Projects to Fill Gaps (Some projects common with Development Plans) – (for details refer Section 5, Part C of Volume 1 of Final Report No. 4.6)					
1	Supplement inflow to Bisalpur Dam	Study various options of supplementing inflow to Bisalpur Dam from Mahi and Chambal rivers, preparation of Detailed Project Reports and Implementation of selected option.	-	Augmentation of water supply to Ajmer and Jaipur cities and other towns being supplied from Bisalpur Dam.	SWRPD and WRD
2	Supplement inflow to Jaisamand Dam (Alwar)	Study various options of supplementing inflow to Jaisamand Dam (Alwar) from Chambal river, preparation of Detailed Project Reports and Implementation of selected option.	-	Augmentation of water supply to Alwar town.	SWRPD and WRD
3	Supplement inflow to Jaisamand Dam (Udaipur)	Study various options of supplementing inflow to Jaisamand Dam (Udaipur) from Anas river and Jakham Dam, preparation of Detailed Project Reports and Implementation of selected option.	-	Augmentation of water supply to Udaipur city.	SWRPD and WRD
4	Supplement inflow to Rajsamand Dam (Rajsamand)	Study various options of supplementing inflow to Rajsamand Dam (Rajsamand) from Anas river, preparation of Detailed Project Reports and Implementation of selected option.	-	Augmentation of inflow to Rajsamand Dam and utilization of storage.	SWRPD and WRD
5	Supplement inflow to Meja Dam (Bhilwara)	Study various options of supplementing inflow to Meja Dam (Bhilwara) from Anas river, preparation of Detailed Project Reports and Implementation of selected option.	-	Augmentation of inflow to Meja Dam and utilization of storage.	SWRPD and WRD
6	Supplement inflow to Ramgarh Dam (Jaipur)	Study various options of supplementing inflow to Ramgarh Dam (Jaipur) from Mej river, preparation of Detailed Project Reports and Implementation of selected option.	-	Augmentation of water supply to Jaipur city.	SWRPD and WRD
7	Construction of Isarda Dam	Preparation of Detailed Project Report for construction of Isarda Dam including its water availability.	-	Augmentation of water supply to Jaipur city.	SWRPD and WRD

S. No.	Recommendations	Proposed Actions	Estimated Cost, Million Rs. (at 2010 price level)	Anticipated Value Addition	Responsibility
8	Construction of Kalisindh Dam Phase II	Further necessary action for construction of Kalisindh Dam Stage II.	-	Increased power production in future.	SWRPD and WRD
9	Construction of proposed Parwan Major Irrigation Project	Preparation of Detailed Project Report for construction of Parwan Major Irrigation Project including its water availability.	-	Increased agriculture and power production in future.	SWRPD and WRD
10	Construction of Dewas Stage III and IV	Preparation of Detailed Project Report for construction of Dewas Stage III and IV and diversion of water to lakes of Udaipur city.	5,681.50	Augmentation of water supply to Udaipur city.	SWRPD and WRD
11	Timely completion of ongoing water supply projects	1. Barmer Lift Canal Water Supply Project Phase I (Source of water: IGNP)	6,886.60	Drinking water supply to Barmer city, 412 villages of Barmer district and 161 villages of Jaisalmer district.	SWRPD and PHED
		2. Pokaran Phalsoond Balotra Lift Water Supply Project (Source of water: IGNP)	14,442.00	Drinking water supply to Pokaran town (Jaisalmer district), Balotra and Siwana towns (Barmer district) and 580 villages of Barmer and Jaisalmer district.	SWRPD and PHED
		3. Chambal-Dhaulpur-Bharatpur Water Supply Project (Source of water: Chambal River)	4,779.90	Drinking water supply to 945 villages of Bharatpur district and 96 villages in Dhaulpur district and urban towns of Dhaulpur (partial), Bharatpur, Kumher, Deeg, Nagar and Kaman.	SWRPD and PHED
		4. Chambal Bhilwara Water Supply Project (Source of water: Chambal River)	7,278.20	Assured drinking water supply to towns and villages of Bhilwara district.	SWRPD and PHED
		5. Chambal-Sawai Madhopur-Nadoti Water Supply Project (Source of water: Chambal River)	4,681.80	Assured drinking water supply to 926 villages and 4 towns of Sawai Madhopur and Karauli	SWRPD and PHED

S. No.	Recommendations	Proposed Actions	Estimated Cost, Million Rs. (at 2010 price level)	Anticipated Value Addition	Responsibility
				district.	
		6. Nagaur Lift Water Supply Project (Source of water: IGNP)	7,610.00	Assured drinking water supply to 5 towns and 502 villages of Nagaur district.	SWRPD and PHED
		7. Jawai-Pali pipeline project (Source of water: Jawai Dam)	6,347.90	Safe drinking water to 531 villages and 10 towns of Pali district.	SWRPD and PHED
		8. Water supply to Keoladeo National Park (Source of water: Goverdhan Drain)	560.40	Rejuvenation of the Park and increased migratory birds.	SWRPD and MoEF
12	Implementation of some proposed drinking water supply projects on priority	9. Barmer Lift Project Phase II (Source of water: IGNP)	7,977.50	Drinking water supply to 691 villages of Barmer district.	SWRPD and PHED
		10. Aapni Yojana Phase II (Source of water: IGNP)	13,300.00	Drinking water supply to 431 villages of Churu district and 13 villages of Jhunjhunu and 6 towns of Churu district.	SWRPD and PHED
		11. Fatehpur-Laxmangarh Project (Source of water: IGNP) Note: This project should also include supply to Sikar town and villages of Piprali block of Sikar district	8,320.00	Drinking water supply to 3 towns (Fatehpur, Laxmangarh and Ramgarh) and 286 villages of Sikar district and to Sikar town and villages of Piprali block of Sikar district.	SWRPD and PHED
13	Reduction in distribution losses of piped drinking water supply schemes	Rehabilitation of piped drinking water supply distribution system considering the following studies: 1) Benchmarking of Urban water supply schemes of Rajasthan (by SMEC) 2) Benchmarking of Rural water supply schemes of Rajasthan (by Ramky Enviro Engineers Ltd.)	-	Reduction in losses resulting in more supply coverage.	SWRPD and PHED
14	Review of Inter-State matters	Inter-State agreements of Rajasthan with Gujarat, Haryana and Punjab should be reviewed for additional utilization of water from outside Rajasthan.	-	Increased water resources availability	SWRPD, WRD and GoR

S. No.	Recommendations	Proposed Actions	Estimated Cost, Million Rs. (at 2010 price level)	Anticipated Value Addition	Responsibility
15	Catchment Treatment to reduce sedimentation of reservoirs	The life span of a reservoir is greatly reduced due to erosion and other development like construction of roads etc. in the catchment area. Adequate preventive measures are thus needed for the treatment of catchment of reservoirs for its stabilization against future erosion and proper cross-drainage.	-	Reduction in reservoir sedimentation and prevention of cutting of catchment resulting in less effect on water availability in reservoirs in future.	SWRPD, WRD, Watershed Development & Soil Conservation Department and Rajasthan State Road Development & Construction Corporation Ltd.
16	Utilization of water stored in abandoned mine-pits	There is a lot of water stored in abandoned mine-pits in Rajasthan. Further studies on feasibility of its utilization should be carried out.	-	Additional water for utilization.	SWRPD and WRD
17	Utilization of National Highway and State Highway storm-runoff	Study on feasibility of utilization of National Highway and State Highway storm-runoff by diverting it to nearby areas/waterbodies should be carried out.	-	Additional water for utilization.	SWRPD, WRD and National and Rajasthan State Highway Authority
18	Utilization of treated brackish groundwater	Treated brackish groundwater of Matasukh mines is being supplied to villages of Jayal Block of Nagaur District. Similar options should be studied in future.	-	Additional water for utilization.	SWRPD, RGWD, PHED and Rajasthan Department of Mines & Geology
19	Utilization of Ghaggar flood water	Study on feasibility of harvesting of Ghaggar flood water draining to Pakistan and its use for augmenting groundwater resources should be carried out.	-	Additional water for utilization, which otherwise is lost.	SWRPD and WRD
20	Utilization of surplus imported water during rainy season	Study on feasibility of utilization of surplus water in IGNP, Bhakra and Gang Canal System during rainy season, if any, for artificial recharge.	-	Augmentation of groundwater resources.	SWRPD, WRD and RGWD
21	Master Plan for Artificial Groundwater Recharge	Master Plan for artificial recharge through available surplus internal surface water and imported canal water should be prepared since more than 60% of the irrigated area is through groundwater, which is facing significantly declining water levels.	-	Augmentation of groundwater resources.	SWRPD, WRD and RGWD

S. No.	Recommendations	Proposed Actions	Estimated Cost, Million Rs. (at 2010 price level)	Anticipated Value Addition	Responsibility
22	Artificial Groundwater Recharge and Waste Water Reuse in Urban Areas	Study on "Artificial Groundwater Recharge and Waste Water Reuse for Jaipur City" was carried out by ANTEA International of France. Similar studies/work should be carried out for other big cities of Rajasthan. Follow up of all such studies to be done by respective departments.	-	Augmentation of groundwater resources and waste water reuse as additional source of water.	SWRPD, WRD, RGWD and PHED
23	Follow up of recent studies carried out in Rajasthan related to water sector	Follow up of Groundwater study and related software developed by ROLTA and Study on Benchmarking of Irrigation Projects by WAPCOS and any other study related to water sector.	-	Proper implementation and monitoring of projects.	SWRPD, RGWD, and WRD
24	Impact assessment of new structures	For any new structures, anicut etc. the impact assessment for downstream water bodies to be mandatorily worked out.	-	Prevention of reduction in inflow to existing water bodies.	SWRPD and WRD
25	Investigations and Studies to find out reasons for reduced inflow to Pushkar Lake and other similar cases	Further investigations and studies should be carried out to find out the reasons for reduced inflows to Pushkar Lake and other similar cases and accordingly preventive measures should be taken.	-	Rejuvenation of Pushkar Lake and other similar cases.	SWRPD and WRD
26	Reduction in evaporation losses from small water harvesting structures	In order to reduce evaporation losses from small rain water harvesting structures, the water should be lifted after the month of March and stored in tankas to meet the drinking water requirement during summer or construct recharge shaft to recharge groundwater and ensure that water recharges by March: as the evaporation is about 50-60% of annual evaporation during the summer months.	-	Reduction in evaporation losses and groundwater recharge.	SWRPD, WRD and RGWD
27	Holistic approach in water resources planning and management	At present, there is no holistic approach and each department of Rajasthan is working without taking into account concern of other relevant department on various water related issues. There should be one department for planning i.e. SWRPD. Restructuring of SWRPD and RGWD is a must to meet the future	-	Integrated water resources planning and management.	SWRPD, RGWD, other related Departments and GoR

S. No.	Recommendations	Proposed Actions	Estimated Cost, Million Rs. (at 2010 price level)	Anticipated Value Addition	Responsibility
		challenges, which is necessary to implement state water policy action plan, community participation, proper data collection, enforcing legal issues, etc.			
Sub-Total			**87,865.80**		
Total			**250,109.72**		

19. Policies and Regulations

19.1 Introduction

In order to give suggestions on policies and regulation, it is important to review the existing policies and law in a state for water resources management. There are several policies and regulations at central level and State level. Each has its own advantages and draw-backs. A brief over-view of the existing policies and regulations is presented in the following sections.

19.2 Existing Policies and Regulations

19.2.1 Policies

19.2.1.1 Conservation Provisions in India's Constitution

The Forty Second Amendment to the Constitution in 1976 underscored the importance of 'green thinking'. Article 48A enjoins the state to protect and improve the environment and safeguard the forests and wildlife in the country. Further, Article 51A(g) states that the "fundamental duty of every citizen is to protect and improve the natural environment including forests, lakes, rivers and wildlife and to have compassion for living creatures".

The Government of India has articulated three policy statements namely, "Policy Statement for abatement of pollution, 1992", "National Conservation Strategy and the Policy Statement on Environment & Development, 1992" as well as the "National Environment Policy of 2006". The Policy Statement for Abatement of Pollution has made provisions for the so-called 'reactive' approach alone. Although it proposed a comprehensive approach "to integrate environmental and economic aspects in development planning, preventive aspects for pollution abatement and promotion of technological inputs to reduce industrial pollutants, and through reliance upon public cooperation in securing the clean environment". However, during last decade, a number of issues and new challenges have emerged in environment sector. Thus, Government of India has pronounced National Environment Policy 2006. This policy covers a large number of issues including the issues related to international commitments.

19.2.1.2 Policy Statement for Abatement of Pollution (1992)

The Policy Statement for Abatement of Pollution has suggested developing relevant legislation and regulation, fiscal incentives, voluntary agreements and educational programs and information campaigns. It emphasizes the need for integration by incorporating environmental considerations into decision making at all levels by adopting frameworks namely, pollution prevention at source, application of best practicable solution, ensure polluter pays for control of pollution, focus on heavily polluted areas and river stretches and involve public in decision-making.

19.2.1.3 The National Conservation Strategy and Policy Statement on Environment and Development, 1992

The National Conservation Strategy and Policy Statement on Environment and Development aimed at "integrating environmental concerns with developmental imperatives…. [to] meet the challenges….by redirecting the thrust of our developmental process so that the basic needs of our people could be fulfilled by making judicious and sustainable use of natural resources." The priorities mentioned in this policy document include the sustainable use of land and water resources, prevention and control of pollution and preservation of biodiversity.

19.2.1.4 The National Environment Policy, 206 contains provisions for conserving

The national Environment Policy contains provisions for conserving national resources, protection of wild life and ecosystems, prevention of pollution, reuse and recycling of wastewater, adoption of clean technology, application of 'polluter pay principle' and amendment in the existing law from criminal to civil suit provisions. The policy focuses more on the international policies, agreements and conventions.

19.2.1.5 The National Water Policy, 2002 National level policy addresses the water

The National Water Policy addresses the water issues including prioritization, allocation, pricing and interstate issues related to water sharing. Policy states about the consumptive use of water, water conservation and quantification of water pollution. It contains provisions for developing, conserving, sustainable utilizing and managing this important water resources and need to be governed by national perspectives. Concern due to water logging, ingress of soil salinity and over–exploitation of groundwater will be addressed on the basis of common policies and strategies. The policy includes improvements in existing strategies, innovation of new techniques to eliminate the pollution of surface and groundwater resources to improve water quality. It has emphasized on water resource planning, development of institutional mechanism, water allocation, groundwater development and participatory approach to water resource management. Regular water quality monitoring programme for both surface and groundwater will be undertaken with particular emphasis on pollution control at source.

19.2.1.6 State Level Policies

The Rajasthan State Water Policy, Feb-2010

The latest state water policy has priority for human and livestock drinking water and other domestic, commercial and municipal water uses but also indicates Environment & Ecology sector as one of the priority in water allocation. It properly covers aspects of water quality and pollution. It also includes quantification of water pollution and its abatement by proper treatment of sewage and industrial effluent before discharging into natural streams or to groundwater recharge and reuse of wastewater.

Sector Policy for Rural Drinking Water & Sanitation (Draft) -2005

The state level policy dealing with the process and quality of drinking water supply and sanitation means in different areas of the State, mostly in rural sectors. Policy links water harvesting practices in households and community. It assigns duties and responsibilities of PRIs and NGOs in source development and water allocation. It stresses awareness for development of optimal and efficient use of drinking water.

The Rajasthan Industrial Policy, 1998

This State Level policy deals with regulation and provisions of industrial infrastructural facilities to industrial sectors. Water is considered as one of the most important sector prioritized after power and communication. Common Effluent Treatment Plants for large industries have been stated and State Pollution Control Board is stated to be associated for pollution checks and management.

The Resettlement and Rehabilitation Policy for Water Sector Development

This specific policy on Resettlement & Rehabilitation (R&R) issues facilitates project implementation by paving the way for R&R in case of Water Sector development projects. This policy envisages compensation to displaced families under different infrastructure projects including the water sector projects.

Urban Development & Housing

This policy specifically deals with urban development and house establishment in the State along with provisions of infrastructural facilities to be provided to the developers. Its relevance in water sector is w.r.t solid waste management.

19.2.2 Regulations

19.2.2.1 Legal Provisions for Water Quality Management

India has also witnessed passage of a variety of environmental laws on prevention of pollution in water as well as a host of environmental regulations.

The Government policy to protect the Environment while undertaking any developmental activity has made it mandatory to introduce the environmental aspects into planning and development process. The Government of India through notification in 1994 made it mandatory to take environmental clearance for certain categories of industries and projects under EPA, 1986. The Rules were amended in 2006 to bring housing complexes under the purview of regulation.

19.2.2.2 The Water (Prevention & Control of Pollution) Act, 1974 as amended

The Water Act deals comprehensively with water issues. It empowers the Government to constitute Pollution Control Boards to maintain the wholesomeness of national water bodies. It enables Central and State Pollution Control Boards to prescribe standards and has provisions for monitoring & compliance and penal provisions against the violators of the Act. It provides the permit system i.e.

"Consent" procedure to prevent and control of water pollution. The Act empowers State Boards to issue directions to the defaulters.

19.2.2.3 Water Cess Act, 1977

The Water Cess Act was adopted to strengthen the Pollution control Boards financially, to promote water conservation. This Act empowers the Central Government to impose a Cess on water abstracted from natural resources by industries and local authorities.

19.2.2.4 Environment (Protection) Act, 1986

The Environment (Protection) Act has a broad coverage in which 'Environment' includes **water**, air and land and there exists an interrelationship among water, air, land, human beings and other creatures. It empowers to take measures in protecting and improving the quality of the environment through preventing, controlling and abating environmental pollution. The Government is authorized to set national standards for ambient environmental quality and controlling discharges to regulate industrial locations, to prescribe procedure for hazardous substance management and to collect and disseminate information regarding environmental pollution. The Act provides for severe penalties for those who fail to comply with or contravenes any provision of the Act.

19.2.2.5 The Manufacture, Storage, Import of Hazardous Chemicals Rules, 1989

These Rules and their amendments under EPA, 1986 has identified the responsibilities of various stakeholders for management of chemicals and containment of spillage. **The Hazardous Wastes (Management and Handling) Rules, 1989** and its subsequent Amendment 2000 were created to provide 'cradle-to grave' or comprehensive guidance to the generators, transporters and operators of disposal facilities among others, and monitoring norms for State governments. **The Municipal Wastes (Management & Handling) Rules, 1999** fix responsibilities to every municipality responsible for the collection, segregation, storage, transportation and disposal of municipal wastes. **The Bio-medical waste (Management & Handling) Rules, 1998** are likewise directed at institutions that generate and handle bio-medical wastes in any form.

19.2.2.6 Central Ground Water Authority

The Central Ground Water Authority was constituted under section 3 of the Environment Protection Act, 1986 to regulate the over-exploitation of ground water and its degradation under the order of Hon'ble Supreme Court of India in 1996.

19.2.2.7 Water Quality Assessment Authority

The Water Quality Assessment Authority was constituted under section 3 of Environment Protection Act, 1986 to protect water quality, regulate water abstraction and maintain minimum flows in different rivers to sustain various beneficial uses.

19.2.2.8 State Level Regulations

The Rajasthan Irrigation and Drainage Act and Rules, 1954 This act deals with the issues related to the irrigation and drainage, to maintain the quality aspects of the surface and ground water resources.

Participation In Management of Irrigation System (PIM) Act, 2000 It provides options for farmer's participation in the Management of Irrigation System and for matters connected with the same.

The Rajasthan Minor Irrigation Works Act This act deals with critical issues related to the minor irrigation works in the State.

The Rajasthan Regulation and Control of The Development and Management of Ground Water Bill, 2006 (Draft) This bill deals with establishment of State Ground Water Authority with the powers to notify areas and uses for regulation and control of the development and management of ground water.

The Dam Safety Act of Rajasthan Specifies the importance of dam regulation and responsibilities of State Dam Safety Organization. Dam Safety Legislation shall be enacted to ensure proper inspection, maintenance and surveillance of existing dams and also to ensure proper planning, investigation, design and construction for safety of new dams.

19.3 Initiatives

19.3.1 Development and implementation of effluent standards and Water quality criteria

The approach adopted to regulate pollution from industrial and domestic sectors is through laying down of standards for various environmental pollutants discharged from industries. The permissible limit set for various pollution parameters is a binding for compliance. All the State Pollution Control Boards (SPCBs) adopt the control of pollution at source through the 'command and control' type of measures. The CPCB has developed Industry Specific Minimum National Standards (MINAS) in 1977-78(CPCB 1977). The policy statement on Abatement of Pollution (MoEF 1992), suggested for replacing the existing 'concentration' based standards by 'mass' based standards. This approach aimed at setting specific limit to encourage the minimization of waste, recycling and reuse of water and the conservation of natural resources, particularly water. Under MINAS, it has evolved effluent standards for several categories of industries. No SPCB is permitted to relax the MINAS. They may, however, make standards more stringent. These standards have been notified under EPA, 1986 by the Government of India. Government has also notified the Environmental Laboratories and Government Analysts under this Act to strengthen the institutional requirements for monitoring.

19.3.2 National River Action Plan (NRAP)

Widespread discharge of untreated sewage and industrial effluents into natural water bodies is deteriorating the quality of surface water as well as ground water and causing damage to the aquatic ecosystems. Principal drinking water supply sources of cities and towns are becoming polluted resulting in increased incidences of water borne diseases, increased cost on health and increased cost of drinking water treatment. Under the National River Action Plan, certain stretches of major rivers with high intermediate levels of pollution were identified by the CPCB. Sewage collection and treatment works are being created to reduce the pollution load of these river stretches. In the first phase, the GAP (Ganga Action Plan), 29 towns were selected along the Ganga River. At present 157 towns are being considered under NRAP out of which about 74 towns are located on Ganga River, 21 on Rajasthan Rivers, 12 on Damodar River, 6 on Godavari River, 9 on Cauvery River, 4 each on Tungbhadra and Satlej Rivers, 3 each on Subarnrekha, Betwa, Wainganga, Brahmini, Chambal, Gomti Rivers, 2 on Krishna River and one each on Sabarmati, Khan, Kshipra, Narmada and Mahanadi Rivers. In Rajasthan, Chambal River was taken up under NRCP.

19.3.3 Environment Impact Assessment

The Government's policy to promote the environment while undertaking any developmental activity has made it necessary to introduce the environmental aspects into planning and development. A new development project requires Ministry of Environment and Forest's appraisal & clearance before it is approved by the Planning Commission. Similarly, in case of any major industrial project requiring licence from the Ministry of Industry, the Licensing Committee will grant licence only after the Ministry of Environment and Forests has reviewed the project to ensure that suitable provisions for protecting environment have been made. The basic objective of Environmental Impact Assessment (EIA) is to identify, predict and evaluate the likely economic, environmental and social impact of any developmental activities and to prepare an action plan for remedy as a part of the overall Environmental Management Plan (EMP). The Government of India through a notification in 1994 made obtaining environmental clearance mandatory for certain categories of industries & projects under Environment (Protection) Act, 1986. The Rules were amended in 2006 to bring housing complexes under the regulation.

19.3.4 Special Drive for 17 categories of polluting industries

The Central Pollution Control Board selected 17 categories of major polluting industries for priority action and directed the State Boards to ensure compliance of standards in these industries. Accordingly, most of the State Boards amended the consent order of all the industries in these categories so that no defaulting unit shall have consent of the Board.

19.3.5 Pollution Control in Small-Scale Industries

In India, over 3.5 million small-scale industries and about 2000 industrial estates exist. Though small-scale industry as a unit may not be severely polluting, but a

cluster of these industries may severely pollute the environment. There are certain industrial estates which are critically polluting the environment. Since small-scale industries are not having adequate resources, space or skilled manpower to treat their wastewater, Govt of India initiated a scheme of common effluent treatment plants (CETPs). These CETPs are partially funded by Government of India and State Government and partially by the industries themselves. There are 12 CETPs working in Rajasthan.

19.3.6 Charters on Corporate Responsibility on Environment Protection

Ministry of Environment and Forests, Govt of India with the help of CPCB has formulated charters on Corporate Responsibility on Environmental Protection (CREP) in respect of 17 categories of highly polluting industries in collaboration with the concerned industries. Charters identify environmental concern and priority areas of Government and facilitate the industries to plan in advance the required investment for completeness of the pollution control systems. For the 17 categories of highly polluting industries, time bound actions have been proposed in the charters and bank guarantee are to be furnished by the concerned units indicating the commitment to the action plan.

19.3.7 Special Drives for Industries Discharging into Rivers and Lakes

On Instance of MoEF, Central Pollution Control Board with the help of State Pollution Control Boards in the country has identified industries which are directly discharging wastewaters into the rivers and lakes. Special time targeted action plans were prepared for these industries to follow. Intensive monitoring is being done to ensure the compliance with the time targets.

19.3.8 Incentives for Control of Pollution

Besides the regulatory mechanism, the government has also introduced major economic incentives for pollution abatement in India, not as alternative to regulation but only as supplementary measures. The Water Cess Act 1977 empower the state pollution control boards to levy a water cess on local authorities supplying water to consumers and on industries on consumption of water in certain specified activities. The Act also provides for a rebate on the water cess payable if the concerned local authority or industry installs a plant to treat sewage or trade effluent. A rebate of 25% on the water cess payable has been provided to those industries that do not exceed the prescribed quantity and also comply with the effluent standards prescribed under the Water Act 1974 and the Environment Protection Act 1986.

Supported by recent legislative, administrative and judicial initiatives, environmental regulation in India become very powerful. The new regulations cover hazardous wastes and chemicals, hazardous microorganisms and transportation of toxic chemicals. Stringent penalties were introduced in the older pollution control laws. The licensing regime is supplemented by "citizen suits" provision together with a statutory "right to information", now enable an aggrieved citizen to directly prosecute a polluter after examining the government records and data. Rules have been notified for environmental auditing of all the industries,

which may cause water or air pollution or generate solid or hazardous wastes. Mandatory worker's participation in plant safety and stringent penalties on high level management for the breach of factory safety regulation are expected to reduce industrial accidents. Vesting of enormous administrative power in the enforcing agencies is also an encouraging step towards improvement of environment. . It also includes adoption of clean technology, conservation of resources, change of concentration based standards to mass based standards, incentives for pollution control, public participation, environmental auditing and Eco-mark on environment friendly products.

19.3.9 Field Operational Manual for Environment Management of Water Resources Projects, February 2013

Though the development of water resources projects brings prosperity and make the state self reliant but at the same time it also creates various environmental complicacies. The negative impacts of the developmental activities many a time prove detrimental to flora, fauna and the human life. The EIA Notification-2006 issued by the Ministry of the Environment and Forest, Government of India includes Environmental Impact Assessment (EIA) to mitigate these negative impacts of water resources development projects. The existing water projects of the state also need to be seen from the environmental screen for the environmental value and sustainability of the projects. Therefore, the necessity of a framework was felt to deal with all the aspects of Environmental Management of the Water Sector of the state, hence the need for developing this Field and Operational Manual was felt which transpired to develop the Manual.

The Environment Management Manual is required: (i) to encompass various issues pertaining to an effective environment management such as obtaining environmental clearance from MoEF, conducting EIA for the Water Resources projects (wherever necessary), preparing EMP and implementing it by designing proper mitigation measures; and (ii) to serve as a guide to strengthening the technical, operational and managerial capabilities required for the concerned personnel to manage the environmental concerns of the Water Resource projects as per the norms of the MoEF.

This Manual guides the Water Resources field experts right from the stage of Pre-Planning to the Operation and Maintenance of the existing Water Resources projects in managing all the environmental aspects of a Water resources project. The Monitoring Formats and the Contractual Specifications given with this Manual, if are filled diligently and monitored carefully, the Environmental Management of the Water Resources schemes in the State could well be taken care of and will ultimately mainstream the identification of the environmental concerns and effective mitigation in the project cycle of the water resource projects or schemes.

19.3.10 Environmental Management Guidelines and Action Plan of SWRPD for Water Sector in Rajasthan, February 2013

Water has vital important for human and animal life, maintaining ecological balance and for economic and development activities of all kinds. The environment

management of water sector has been given prime importance in water resources planning activity.

There are several department /agencies involved in the development, use and monitoring of water resources the important ones are Irrigation, Agriculture Department, Command Area Development Department, State Groundwater Department, Public Health Engineering Department, State Pollution Control Board, Department of Industries and Department of Environment and Forest. Although these department / agencies are working in their respective area but to achieve desired goal of integrated water resources planning and management, there should be coordination among these departments. The State Water Resources Planning Department (SWRPD) was created to achieve an integrated and multi-sectoral approach to the planning, development and use of the State's Water Resources.

For management of environmental issue separate units have been formed under SWRPD, Environmental Department and Irrigation Department.

To enhance the monitoring of environmental aspects and identify an action plan for SWRPD, an attempt has been made through this document. These guidelines envisaged a suggested action plan for SWRPD, where SWRPD will act as a nodal agency for water sector planning and will bring out major environmental concerns of water sector in Rajasthan and will publish related data information in public domain. This will not only improve environmental awareness and management in water sector of the State but, will also act as tool to strengthen SWRPD's data bases, environmental consciousness and management.

The following reports shall be an output of Environmental Management guidelines and Action Plan:

1. Regular collection of data as per formats provided for different departments.
2. Preparation and publication of Quarterly and Annual Environmental Management Reports.

19.4 Strategies for Implementation

The pollution control regulations in Rajasthan are being implemented by Rajasthan State Pollution Control Board, under the provision of Water (Prevention and Control of Pollution Act, 1974 and Environment (Protection) Act, 1986. The Act provide for a permit system or "Consent" procedure to prevent and control water pollution. The Act generally prohibits disposal of polluting matter in streams, wells and sewers or on land in excess of the standards established by the state boards.

A person must obtain consent from the state board before establishing any industry operation or process, any treatment and disposal system or any extension or addition to such a system which might result in the discharge of sewage or trade effluent into a stream well or sewer or onto land. The state board may condition its consent by orders that specify the location, construction and use of the outlet as well as the nature and composition of new discharges.

The Act empowers a state board, upon thirty days notice to a polluter, to execute any work required under consent order which has not been executed. The board may recover the expenses for such work from the polluter. The Act gives the state boards the power of entry and inspection to carry out their functions. Moreover, a state board may take certain emergency measures if it determines that an accident or other unforeseen event has polluted a stream or well. These measures include removing the pollutants, mitigating the damage and assuming orders to the polluter prohibiting effluent discharges.

Under the provisions of the Water Act, there is no difference between industrial and domestic pollution. However, because the responsibility of sewage treatment lies with concerned ULBs and most of the time they do not have adequate resources to fulfil this responsibility with sewage treatment in most of the cases is lagging behind. This is the biggest cause of pollution in the State. Though the Water Act does not discriminate between pollution from industrial and domestic sources, domestic pollution is not regulated in the same manner because the responsible agency is a public body providing a highly subsidized service to society. In order to help the ULBs the Government of India launched the Ganga Action Plan and subsequently National River Action Plan and established several STPs. However, today their operation and maintenance is in a dismal condition.

Environment (Protection) Act, 1986

After the Environment (Protection) Act, 1986 (EPA) passed by the Parliament, its provisions have strengthened the enforcement of Water Act, 1974. The potential scope of the Act is broad with environment' which include water, air and land and interrelationship which exist among water, air, land, human beings, other creatures, plants, micro organisms and property. Section 3(1) of the Act empowers the Centre to take all such measures as it deems necessary or expedient for the purpose of protecting and improving the quality of the environment and preventing, controlling and abating environmental pollution. Central Government is authorized to set new national standards for ambient quality of the environment and standards for controlling emissions and effluent discharges; to regulate industrial locations; to prescribe procedures for managing hazardous substances; to establish safeguard for preventing accidents; and to collect and disseminate information regarding environmental pollution.

The EPA was the first environmental statute to give the Central Government authority to issue direct written orders including orders to close, prohibit or regulate any industry operation or process or to stop or regulate the supply of electricity, water or any other services (Section 5). Other powers granted to the Central Government to ensure compliance with the Act include the power of entry for examination, testing of equipment and other purpose (Section 10) and power to take samples of air, water, soil or any other substance from any place for analysis (Section 11). The Act explicitly prohibits discharge of pollutants in excess of prescribed standards (Section 7). There is also a specific prohibition against handling. Hazardous substances except in compliance with regulatory procedures and discharges (section 8). Persons responsible for discharges of pollutants in excess of prescribed standards must prevent or mitigate the pollution and must report the discharge to government authorities (Section 9, 1).

The Act provides for severe penalties. Any person who fails to comply with or contravenes any of the provisions of the Act, or the rules or directions issued under the Act shall be punished for each failure or contravention, with a prison term of up to 5 years or a fine up to 1 lac Rs. or both. The Act imposes an additional five up to Rs. 5000 for every day of continuing violation (Section 15 (1)). If a failure or contravention occurs for more than one year after the date of conviction, an offender may be punished with a prison term which may extend to seven years (Section 15 (2)).

The Act empowers the central government to establish standards for the quality of the environment in its various aspects, including maximum allowable concentration of various environmental pollutants (including noise) for different areas. These standards could be based on ambient levels of pollutants sufficient low to protect the public health and welfare. Emission or discharge standards for particular industries could be adjusted to ensure that such ambient levels are achieved. The Environment (protection) Rules, 1986 allow the State or Central authorities to establish more stringent standards based on recipient system.

The EPA includes a citizen's suit provision (Section 19.6) and a provision authorising the Central Government to issue direct orders to protect the environment (Section, 5). The Central Government may delegate specified duties and powers under the EPA to any officer, State government or other authority (Section 23). The Central Ministry of Environment and Forests (MoEF) is responsible for making rules to implement the EPA. The Ministry has delegated the powers to carry out enforcement to the Central and State Pollution Control Boards in the country.

The MoEF has so far enforced several rules and regulations. It has adopted industry specific standards for effluent discharge and emissions different categories of industries. The Ministry has also designated certain State and Central Officials to carry out specified duties under the Act and has designated specific laboratories for testing the samples of air water and soil obtained under the Act.

There are many central and state level legislations as summarized in the above sections. In a nutshell, all the current laws deal with diverse water services and have created multiple bodies and jurisdictions. State government have jurisdiction over various aspects of Water development such as ownership; planning and implementation of irrigation projects, water works schemes, supply of water, contracting, levy and recovery of taxes, fees and levies etc. However, existing laws in most States do not specify what this responsibility entails for water resources systems, not do they envisage any clear role for water management and governance in a holistic way.

The overall analysis of increasing demand and supply gap indicate that following major key issues needs to be addressed: 1) Conflict resolution among riparian states, 2) centralization tendency in water law and policy by the State government, 3) absence of legal integration of states, 4) lack of user participation policy, and 5) water entitlement and abstraction rules.

19.4.1 Present Approach to Water Pollution Control

The basic objective of the Water Act is to maintain and restore the wholesomeness of water by prevention and control of pollution. The Act does not define the level of wholesomeness to be maintained or restored in different water bodies of the country. The task of defining these levels for different water bodies is given to the Central Pollution Control Board (CPCB), which has initially taken the use of water as the basis for identifying the water quality objectives for different water bodies. Therefore, it has classified the national aquatic resources according to their uses. The CPCB has also identified primary water quality criteria for different uses to act as the yardstick for the preparation of different pollution control programs. The use-based classification system is given in Table 19.1.

Table 19.1: Use Based Classification of Surface Waters in India

Designated-Best-Use	Class of water	Criteria
Drinking Water Source without conventional treatment but after disinfection	A	1. Total Coliforms Organism MPN/100 ml shall be 50 or less 2. pH between 6.5 and 8.5 3. Dissolved Oxygen 6 mg/l or more 4. Biochemical Oxygen Demand 5 days at 20°C, 2 mg/l or less
Outdoor bathing (Organised)	B	1. Total Coliforms Organism MPN/100 ml shall be 500 or less 2. pH between 6.5 and 8.5 3. Dissolved Oxygen 5 mg/l or more 4. Biochemical Oxygen Demand 5 days at 20°C, 3 mg/l or less
Drinking water source after conventional treatment and disinfection	C	1. Total Coliforms Organism MPN/100 ml shall be 5000 or less 2. pH between 6 to 9 3. Dissolved Oxygen 4 mg/l or more 4. Biochemical Oxygen Demand 5 days at 20°C, 3 mg/l or less
Propagation of Wild life and Fisheries	D	1. pH between 6.5 to 8.5 2. Dissolved Oxygen 4 mg/l or more 3. Free Ammonia (as N) 1.2 mg/l or less
Irrigation, Industrial, Cooling, Controlled Waste disposal	E	1. pH between 6.0 to 8.5 2. Electrical Conductivity at 25°C, Max. 2250 micromhos/cm 3. Sodium Absorption Ratio Max. 26 4. Boron Max. 2 mg/l

19.4.2 Use of the Water Quality Classification System

For the preparation of a pollution control plan for any water body one has to define its target water quality to identify the extent of pollution control needed. The present status can also be used for prioritization. The CPCB is a national apex body responsible for preparation of pollution control action plans for the country. CPCB therefore needs a scientifically sound yardstick. The "best designated use" yardstick is based only on primary criteria, and needs further scientific support. The criteria

should be such that they can support not only the designated uses but also the ecological sustainability of the water body (wholesomeness), which is the prime objective of the Water Act, 1974. Hence, the CPCB has evolved a methodology for water quality evaluation which can integrate all the water quality parameters. This methodology is known as biomonitoring methodology.

19.4.3 Industrial Pollution Control

Under the provision of Water Act, every polluting industry or municipality has to obtain consent from the concerned SPCB/PCC. Establishment of treatment plant for the effluents generated from the industrial activities is one of the several conditions prescribed in the consent order. The concerned SPCBs/PCCs regularly monitor the industrial effluent treatment plants, depending on the availability of resources. The frequency of visit depends on size of the industry, magnitude of pollution, resources available, social and political importance of the problem. Apart from regular scheduled monitoring CPCB also carry out vigilance monitoring for which it has constituted surveillance squads. Seventeen categories of Industries identified by Ministry of Environment & Forests, Government of India as highly polluting and covered under Central Action Plan. The programme is rigorously followed up by the Central Pollution Control Board. The status of these industries is continuously obtained from the SPCBs, collected, compiled and reported regularly to Ministry of Environment & Forests. Similarly industries discharging directly into rivers and lakes were identified and are rigorously monitored for compliance. CPCB regularly issues directions to the concerned SPCBs/PCCs under Section 18 of Water act in case of defaulting industries found in their respective states. CPCB also issues directions to take immediate measures or close down the defaulting industries based on the grave situation arise in any part of the country followed by vigilance monitoring carried out by it. EIA is most powerful tool to regulate industrial pollution. Any industry before establishment has to obtain environment clearance, which has very elaborative assessment and requirement for environment protection including water conservation and pollution control. To strengthen the pollution control boards by providing money for equipment and technical personnel and to promote water conservation by recycling, Parliament adopted the Water Cess (prevention and control of Pollution) Act, 1977. The Act empowers the Central Government to impose a cess on water consumed by industries listed in schedule I of the Act. Specified industries and local authorities are subject to the cess if they use water for purposes listed in schedule II of the Act. The rates are revised several times. The latest revision was passed by the Parliament in 2003.

Apart from command and control approach, CPCB also adopted several other approaches including Corporate Responsibility on Environment Protection (CREP), wherein a time targeted action plan was formulated for each of the 17 categories of industries in collaboration and mutually agreement with respective industrial association and being implemented. The industries have to give bank guarantee to ensure their compliance with time target. In case they are not able to comply, the bank guarantee would be forfeited. Similarly, there are many economic incentives and voluntary commitments from the industries to comply. Environmental Audit is another effective tool to prevent pollution and conserve resources.

19.4.4 Pollution Control in Small-Scale Industries

Though small-scale industry as a unit might not be a significant polluter, a cluster of these industries may severely pollute the environment. There are certain industrial estates which are critically polluting the environment. Since many small-scale industries do not have sufficient resources, space or skilled manpower to treat their wastewater, the Government of India initiated a scheme of common effluent treatment plants (CETPs). These CETPs are partially funded by the Government of India and State Governments and partially by the industries themselves. A total of 134 CETPs are working today in the country out of which 27 are in Rajasthan. However, there are a large number of small scale industries located in residential areas, for which similar efforts is not feasible, and thus they continue to discharge their untreated wastewater into the sewage transport system of the city. The management and performance of many of these CETPs is not satisfactory for various reasons (CPCB, 2005). There are 12 CETPs working in Rajasthan.

19.5 Adequacy in Enforcement

Although, the above enforcement framework for industrial pollution control could brought a large change in the behaviour of the industries and was successful in reducing industrial pollution in the country in almost all the large and medium industries. However, in case of small-scale industries the enforcement is still weak due to various reasons. The most important one is related to their locations, insufficient resources, skilled manpower and space. ***Moreover, nearly 80% of the water pollution is caused by discharge of*** **untreated** ***domestic wastewater, which is very often from the Government supported PHEDs and ULBs due to lack of technical, managerial and financial capacities leading to such unhealthy practices. Thus even if the all industrial effluents are fully treated to the stipulated levels, the water quality objectives cannot be achieved without similar surveillance and strict adherence to water quality protocol.***

19.6 Ecology and Environmental Flows

The basic objective of NRCD is conservation of rivers by way of restoring their ecosystems to their natural structures and functions. Initially it was thought that the pollution of rivers was the main cause for disturbing the ecosystem and that major pollution is coming from the urban centres located along the rivers. The NRCD with the help of concerned State agencies established sewage treatment plants to achieve a reduction in pollution from urban centres. However, at a later stage of implementation it was realized that sewage treatment alone might not be sufficient to restore the river's ecological integrity because it was seriously affected by low-flow or no-flow conditions prevailing over a considerable portion of the rivers in Rajasthan and their tributaries.

Many living creatures need perennial flow in the river because they complete their lifecycle in more than a year. They also need a natural flow regime, which means floods and lean flow conditions for different stages of their life cycle. Until this complexity is understood properly, any change in flow regime will cause many

vital living creatures to vanish and cause serious ecological damage in the river, thus violating the principal objective of NRCD.

The flow is also needed to continuously transport the wastes and to maintain a reasonable capacity in the rivers to assimilate the residual pollution that needs to be discharged even after proper treatment. As no technology, which is presently economically viable in the Indian context, can remove all pollution from wastewater, some residual pollution will be found in the treated effluent, which needs to be assimilated by the river ecosystem. Due to heavy abstraction of surface and groundwater in the catchment area of the rivers in Rajasthan, the rivers and their tributaries remain dry for a considerable period in a year. In order to maintain the environmental flows in these rivers, it is important that water resources are first optimally utilised with water conservation as the goal and then augmented in the entire basin in a very large way duly ensuring that the water table never falls below the riverbed in any reach of a river and its tributaries. This needs a massive effort in groundwater recharge, revival of the village ponds, watershed development, micro-catchment treatment, optimising cropping patterns and irrigation demands, water conservation integrated in urban planning, recycling of wastewater and overall economy in water use. This would further need significant institutional strengthening to manage and operate all water related activities with full cost recovery.

As per the norms of Ministry of Environment and Forests, Government of India, a hydrological year has been segregated as below:

- ***Season I***: This season is considered as high flow season influenced by monsoons. It covers the months from July to September
- ***Season II***: This season is considered as average flow period. It covers the month of October and November and this period is the transitional period between the wet and dry period.
- ***Season III***: This season is considered as low or lean or dry flow season. It covers the months from December to June.

The recommended Environmental Flows as per the norms of MoEF are given in Table 19.2. The Environmental Flows are considered for 90% dependable year in hydroelectric project and 75% dependable year in irrigation projects.

Table 19.2: Recommended Environmental Flows as per the norms of MoEF

Season	Months	Percentage of flow
Season-I	July to September	30% of average discharge for period from July to September
Season-II	October to November	25% of average discharge for period from October to November
Season-III	December to June	20% of average discharge for period from December to June

The above norms need to be implemented for river Chambal and Mahi, which are the only perennial rivers in Rajasthan. Hence, it is suggested that on

dams/barrages/weirs on these rivers, the environmental flows should be released as per MoEF norms.

19.7 Major Constraints to Pollution Control

19.7.1 Legal and Administrative Constraints

Water in the Constitution of India

The Constitution of India recognizes the essential tenet of equal access to water. Article 15(2) of the Constitution explicitly states that no citizen shall 'on grounds only of religion, race, caste, sex, place of birth or any of them' be subject to any disability, liability, restriction or condition with regard to 'the use of wells, tanks, bathing-ghats. Article 21 which speaks of the right to life has been liberally interpreted by the Indian Supreme Court to include all facets of life. The directive principles of state policy (DPSP) which the Constitution in Article 37 declares to be non-justiciable, recognize the principle of equal access to the material resources of the community. Article 39 (b) mandates that "*the State shall, in particular, direct its policy towards securing that the ownership and control of the material resources of the community are so distributed as best to subserve the common good*". Article 51-A(g) casts a fundamental duty on every citizen of India "*to protect and improve the natural environment including forests, lakes, rivers, wild life and to have compassion for living creatures*".

Legislative powers are distributed between the Parliament of India and the Legislative Assemblies of the different States. Under Article 245 of the Constitution, Parliament makes laws for the whole or any part of the country and a legislature of the State for the whole or any part of the territory of the State. The topics of legislation on which the Parliament has exclusive powers to make laws are set out in List I (Union List) of the Seventh Schedule and the topics over which the State legislatures have exclusive powers are set out in List II (State List) of the Seventh Schedule. List III is the 'concurrent List' enumerating the topics over which both the Parliament and State legislatures can make laws. Entry 56 in the Union List pertains to "*regulation and development of inter-State rivers and river valleys to the extent to which such regulation and development under the control of the Union is declared by Parliament by law to be expedient in the public interest*". In the exercise of this power, the Parliament enacted the River Boards Act, 1956, although this law has remained largely in operative. The aspect of resolving disputes between States in relation to sharing of river waters finds a place in Article 262 of the Constitution which envisages the creation of an exclusive tribunal for the purpose. Accordingly, the Parliament has enacted the Inter-State Water Disputes Act, 1956. The Parliament can, under Article 252, make laws even on topics in respect of which it has no powers, provided the legislatures of two or more States resolve that Parliament should make such laws. Thus, we have the Water (Prevention and Control of Pollution) Act, 1974, which was a law on a topic relatable to Entries 6 and 17 of the State List13. The justification for a central law to tackle the growing problem of pollution of rivers and streams was traced to the inadequate and unsatisfactory nature of local laws. In the context of water pollution, another significant central legislation is the Environment (Protection) Act, 1986,

under which several notifications issued by the Ministry of Environment and Forests on various aspects of the subject.

Environment Impact Assessment (EIA)

Although EIA processes consider water as component of environment, the impact of a proposed activity is evaluated only on quality, whereas many developmental activities cause serious impacts on quantity and ultimately on the quality of water. This is not evaluated in integrated and holistic manner, which results in a large number of developmental activities e.g. industries, housing complexes, etc., coming up in an area consuming large quantities of ground and surface water causing their depletion in the area. There is a need for evaluation of impact on quantity and quality in cumulative way of all the activities in an area and its impact zone should be demarcated so that any new proposed developmental activity takes care of already existing impacts.

Incomplete inventory of polluting activities

Preparing a comprehensive inventory of polluting activities is one of the most important activities of pollution control boards for rational planning of pollution control strategy. It helps in prioritization of pollution control efforts and evaluating outcome of the various measures taken. In none of the SPCBs including RSPCB, is a complete inventory of all the polluting sources available. Inventories are generally incomplete and not updated regularly.

Regulation of Sewage Pollution

The discharge of untreated sewage contribute highest amount (nearly 90%) of the pollution of aquatic resources in the Rajasthan, and sewage and trade effluent need to be regulated equally under the provisions of Water Act, 1974, the RSPCB focuses its attention and resources towards industrial pollution control leading to non-achievement of the objectives of restoring water quality in the water bodies.

Standards and Compliance

Complying with the Minimum National Standards (MINAS) fixed by the CPCB requires that near-the-maximum effluent reduction technically achievable must be done. It has been found that a significant proportion of small scale industries discharging trade effluents to water stream do not have treatment plants especially those located in residential areas. It has also been observed that a significant proportion of polluting units, which have some treatment mechanism, do not comply with standards. The punitive action by RSPCB is more or less tied up with litigation and considerable proportion of cases are pending for several years. The RSPCB is, sometimes, not able to exercise the powers to force compliance by stopping electricity supply or water because of interference by powerful pressure groups. Credible action requires formation of sufficiently empowered legal bodies to decide these cases expeditiously.

Monitoring Water Pollution

Although water quality monitoring is essential for the RSPCB to judge their performance and plan their activities in a rational manner, this activity gets least priority due to more emphasis on industrial effluent monitoring. This affects the quality and quantity of monitoring work being done by the RSPCB. Moreover, it is not possible to judge their performance as their focus is industrial pollution control and industrial pollution is much smaller in quantity as compared with domestic sewage, which is not being regulated.

Multiplicity of Organizations

There are a large number of organizations working on different aspects of water resources. They have their own agenda and their own targets to be achieved. Little cooperation exists between these agencies responsible for the use and management of water resources in different sectors such as environment, public health and agriculture. The result is a planning process which does not take into account the needs of these different interest groups and lacks accountability on the part of any given agency. The major bottleneck in an effective policy formulation and implementation is the current institutional set-up involving various government agencies. Further, there is a separation of responsibilities on the basis of water quality and quantity. As many as eighteen agencies are involved in water use and its management. Such a fragmentary approach, both at the central and state levels, results in duplication and ambiguity of functions and discourages unitary analysis of this scarce resource.

Organizational Structure of RSPCB

Monitoring is an expensive pursuit and must be staffed rationally to be economical and efficient. However, in RSPCB there is a severe shortage of staff, lack of technical persons and professionals in the boards. The hypothesis that pollution intensity is directly proportional to the availability of staff per industrial unit does not bear out. Non-filling of the sanctioned strength is one of the predominant factors behind the widely varying per unit staff ratios across RSPCB. The absence of any norm for staffing may also have contributed to this.

There is wide variation in the staff available for monitoring compliance of industrial pollution. The RSPCB is basically scientific/technical organization and should have at least 80% of their staff as technical/scientific. If we look at the functions of RSPCB as defined under the Water Act, 1974 or Air Act, 1981, almost all the functions are technical in nature. The role of non-technical staff is supportive and administrative work related to manpower and financial management. There is a need to carry out a work study and modify the structures of RSPCB to make them more responsive and efficient.

19.7.2 Resource and Social Constraints

Rapid Urbanization

Rajasthan is urbanizing very fast resulting in steep increase in waste generation. Due to inadequate resources, the waste collection and disposal facilities are grossly inadequate. The limited efforts in form of the NRCP or NLCP could not cope with the fast growth of sewage in the State. Discharge of untreated domestic wastewater is predominant source of pollution of the rivers and groundwater in the State. The treatment facilities are grossly inadequate and additional facilities may cost enormous resources. The facilities created to treat wastewater also do not function properly in most of the cases. Any effort on augmenting sewage treatment is nullified by fast urban growth.

Lack of Public Participation

Inadequate policy and regulation, combined with a non-transparent and non-participatory process, is at the root of many of the water management problems plaguing the State. Until now, wastewater management projects have been the almost exclusive domain of government agencies. Government led and funded wastewater management projects have seldom involved the private and volunteer sectors to ensure that the needs of the public are met. Furthermore, full funding of the projects has resulted in low cost recovery and an unrealistic valuation of users' willingness to pay.

19.7.3 Technical Constraints

Inadequate Volumes in Receiving Waters

Although the MINAS, is mainly technology based, some consideration is given to the receiving water body based on the assumption that in the receiving water body at least 10 times dilution is available to achieve the ambient water quality objective in the immediate vicinity of the downstream. In the recent past due to over use of surface and ground waters to fulfil the ever-increasing demand of agriculture, industrial and domestic uses, the water level in aquatic resources of Rajasthan is gradually decreasing. As a result, the assumption of 10 times dilution is no more valid in many parts of the State. This poses great difficulties to achieve the ambient water quality objective (wholesomeness) even after implementing MINAS. This is a challenge before the Rajasthan State Pollution Control Board and the polluters. Thus, it has become necessary to achieve progressive reduction or elimination of effluent discharges. It implies adoption of no waste or low waste technologies through new treatment methods which can fulfil the above objective.

19.7.4 Information Constraints

A large number of organizations are generating a considerable amount of very useful data on water resources, collection of which is cost and labour intensive. However, this data is not easily accessible. Generating similar data by another organization would be a wasteful exercise at a heavy cost on public money. For example, CWC is generating flow data on almost all important rivers in the country

including rivers in Rajasthan. However, the data of the Ganga basin is classified and not made available to users even for scientific work. Similarly, the data on rainfall, run-off, water table, recharge, groundwater abstractions and water quality of surface and groundwater are being regularly acquired by different agencies are not being shared on regular basis. There is hardly any interaction among these organizations for optimization of their networks to make them more useful. Inadequate data on water resource availability and use has hampered attempts to accurately determine water quantity and quality situation in the State. In addition, the lack of standardized procedures and guidelines has made it difficult to evaluate performance and to facilitate reporting and data collection. RSPCB monitors water quality and provides it to the public through web-site and published reports. The conclusions drawn in these reports on the effectiveness of pollution control efforts, water quality trends, identification of areas in need of restoration, prioritization of pollution control programme and nature and magnitude of pollution control needed, are incomplete for want of water quantity information. This is because the water quality is a dimension of its quantity and in order to draw meaningful conclusions, it is important that water quantity data is incorporated in the quality data. The flow measurement is a labour and resource intensive exercise, requires specialized skill and knowledge. Central Water Commission is regularly measuring the flow of different rivers. If this data is made available to the pollution control boards and public, they can draw much better information out of the water quality data they are collecting. Insufficient awareness of or access to information has led to poor compliance with regulations. The main problems identified in this regard are: (a) lack of information on water quality, and quantity or incomplete and unreliable data and limited public access to information, especially through public education program and freedom of information laws; (b) water quantity or flow data not made public and (c) limited opportunity for the involvement of major groups, including youth, social workers, associations, NGOs and women in influencing public policy outcomes.

19.8 Proposed Policy Initiatives

19.8.1 Policy to Address Pollution Abatement

Sewage Collection and Treatment in all the Significantly Polluting Urban Centres

The total water supply in the Class-I cities and Class-II towns in the Rajasthan harbouring population of about 1.26 crore and wastewater generation is about 1699 MLD. The treatment capacity exists for only 192 MLD of wastewater, which merely 10.5% of the total sewage generation in the State. It is also observed that due to lack of proper collection facilities in most of the cities and towns the wastewater either flows in storm water drains often unlined or accumulates in the vacant plots, low-lying areas percolates in the ground and pollute the groundwater. The wastewater, which flows in storm water drains ultimately leads to receiving water bodies and pollute them. Thus, surface and groundwater in and around urban centers especially large urban centers is seriously affected by discharge of untreated urban wastewater. For creating such a capacity a massive investment and a continuing commitment to future such investments are needed. Providing such funding from exchequer's money is detrimental to the economy of the State. Thus, it

is important that the funding is raised from the beneficiaries following the 'Polluters pay principle'. In all the Class-I cities and Class-II towns sewage treatment plants needs to be established with adequate resources available for effective O&M of the sewage treatment plants.

Regulatory Measures for Sewage Pollution

The following framework is proposed for implementation:

- Sewage should be regulated in the same way that industrial effluents are regulated; i.e., through consent and compliance monitoring as per the Water Act, 1974 (see Section 18.2.2.2).
- Respective ULBs should be made responsible for compliance, keeping in view the attainment of bathing water quality in the rivers of Rajasthan, by establishing sewerage systems and STPs with the appropriate specifications.
- The "***Polluter Pays***" principle needs to be imposed for recovering the full cost of pollution control from the beneficiaries.
- ULBs should have effective management and monitoring system to ensure proper functioning of STPs and for monitoring discharges into water bodies.

Techno-economic aspects

- Effective technologies need to be selected
- Since 1991, large-scale changes have been initiated in India's economy with the liberalization and privatisation in almost every aspect of the economy which has also been subject to pressures of globalisation. It is suggested to pilot a few privatised waste management services with appropriate tools of process monitoring to further refine and develop an effective PPP model.
- Effective management system needs to be established to monitor and manage the treatment plants. Presently the ULBs have implicit roles of a provider, manager and regulator. This should be changed and the regulation function should be given to independent bodies similar to those in the power and telecom sectors.

19.8.2 Industrial Pollution Control

The framework for regulating industrial pollution is sound and only small adjustments need be made to address shortcomings. The capacity for monitoring by CPCB and RSPCB is severely constrained by resources – most particularly with regard to manpower.

Additional Regulatory Measures

- Strengthening the monitoring of compliance by RSPCB and vigilance monitoring by CPCB/MoEF, by increasing the numbers of qualified and trained personnel to the level necessary to deal with the task at hand. This makes it necessary to empower these agencies acquire the financial resources to ensure long-term sustainability.

- Regulation of transport and storage of effluents within or outside premises under the Water Act by imposing a consent condition and effective monitoring, including on-line monitoring at strategic locations.
- Strict regulation of groundwater pollution under the Water Act. This needs to be adequately regulated. This will also require repealing of the Indian Easement Act.
- Corporate Responsibility for Environmental Protection (CREP) programme needs to be further strengthened.
- All the Small Scale Industries in residential areas need to be shifted to identified industrial areas and mandated to ensure effluent treatment by either individual or common effluent treatment plants – for which these industries must pay. This plant should be regulated under Water Act.
- Incentives should be given to new residential developments having their own recycling and reuse systems and their own fully functional sewage treatment systems.

19.8.3 Market Based Instruments (MBI)

Besides the 'command and control' regulatory mechanism the government has also introduced major economic incentives for pollution abatement in India, not as alternatives to regulation but only as supplementary measures. The Water Cess Act was introduced in 1977, empowering the state pollution control boards to levy a cess on local authorities supplying water to consumers and on consumption of water for certain specified activities. The Act also provides for a rebate on the cess payable if the person or local authority concerned installs a plant to treat sewage or trade effluent. Until now, regulatory instruments have been heavily relied upon. Economic instruments, typically in the form of wastewater discharge fees and fines, have been introduced to a lesser extent. Compared with economic instruments, the advantages of the regulatory approach to water pollution control is that it offers a reasonable degree of predictability about the reduction of pollution,

Box-1 Market Based Instruments v/s Command and Control

There is a wealth of information available on the need for introducing Market Based Instruments (MBIs) in pollution control system. The NEP, 2006 also highlights needs for such instruments in present regulatory system. The present environmental redressal mechanism is predominantly based on doctrines of criminal liability, which have not proved sufficiently effective, and need to be supplemented by market based instruments. The main argument forwarded in favour of this approach is that uniform standards of pollution within an industry irrespective of the scale of operation, though legally valid and desirable, are inequitable. It is suggested that common effluent treatment plants (CETPs) be set up by RSPCB / private bodies in industrial clusters where large number of polluting SSIs are available and units be charged as per the marginal cost of abatement of pollution.

A large number of STPs are established under NRCP and by the industries for treatment of their effluents. It is important that these assets work effectively; many industries may not operate the ETPs if running cost is high/ lax supervision/ collusion. To obviate the above problems, it is suggested that the Acts may be amended to provide quasi-judicial powers to enforcement officers of SPCBs. Such powers should include powers (a) to levy spot fine in case of violations, which should be 5-10 times operational cost of running the ETP for the period before the last visit and the earlier one, (b) to provide for arrest/detention of persons responsible for toxic waste pollution; (c) to call for documents which might throw light on the above issue and (d) to record statements. This process is to be backed up by an Appellate Authority, which can provide remedy for industries in case of departmental abuses/excesses.

i.e. it offers authorities control to over what environmental goals can be achieved and when they can be achieved. A major disadvantage of the regulatory approach is its economic inefficiency. Economic instruments have the advantages of providing incentives to polluters to modify their behaviour in support of pollution control and of providing revenue to finance pollution control activities. In addition, they are much better suited to combating nonpoint sources of pollution. The setting of prices and charges is crucial to the success of economic instruments. If charges are too low, polluters may opt to pollute and to pay, whereas if charges are too high they may inhibit economic development. Against this background, it seems appropriate, therefore, to apply a mixture of regulatory and economic instruments for controlling water pollution.

19.8.4 Capacity Building

Technological capacity building for enforcing pollution control and environmental protection has been very weak in India. Skill development in environment management, professionalization of conservation groups and strengthening environmental mediation are some of the major steps needed in this direction.

Capacity building must be based on an examination of the water and wastewater management sector to analyse their physical and institutional characteristics in detail, define opportunities and key constraints for sustainable development, and then select a set of short- and long-term action programmes.

Very often the water sector performs poorly because of non-coordinating and vertical institutional arrangements. If these can be improved, structural constraints to effective coordination can be removed. Water is a finite resource and, therefore, demand management is even more important than new development because of the increasingly high cost of developing new sources. Additional supply created from a new water development has in the past been soon fully used without any serious attempts being made at conservation or demand management. Countries must build "capacities" in order to achieve the goal of good sector development, which is effective in service delivery, efficient in resource use and sustainable. These include the following:

- Institutional development, including community participation.
- Changing the emphasis from capital creation to effective operation and maintenance of STPs and ETPs for enhanced efficiency.
- Human resources development and strengthening of managerial systems.
- Price setting, cost recovery and the enforcement of rules, are more difficult to implement than regulation (of water quality, for example). Therefore, strategies to achieve these deserve priority.
- Many inefficiencies can be eliminated by allocating the right mandates and by reviewing the performance of the arrangements regularly. This will render organizations more alert and target-orientated.
- Facilitation of O&M and cost recovery.
- Organizations must develop the right expertise profile.

A number of instruments can be applied in capacity building. These are:

- Technical assistance for institutional change, which may include policy, micro or macro-economic structures, management systems, and administrative arrangements.
- Training for change at different levels of decision-makers, senior staff and engineers with managerial assignments, junior staff and engineers with primarily executive tasks, technicians and operators, and other stakeholders (such as caretakers and people in local communities who have undertaken to operate or to manage community-based systems).
- Education of prospective experts who will play a role in the sector. This encompasses physical and technological sciences, as well as financial and administrative management, and behavioural sciences.
- The water pollution control sub-sector is so complex and develops so fast that in India not more than 10 per cent of the required technical expertise (as university graduates) is available. Many graduates are inadequately prepared for the tasks

19.8.5 Wastewater as a Resource

If there is no dilution available in a receiving water body, it is important that no wastewater is discharged into it even after treatment. The effort should be to use all the wastewater after proper treatment. There are many cases where the sewage or industrial wastewater is treated and used for various inferior uses. Many companies are coming in this business. Focus should be to promote such business. This will benefit the water quality in many ways.

- reduce pollution
- save water
- save nutrients
- reduce over-exploitation of water resources

19.8.6 Policy to Address Water Resources Augmentation in the Basin

Addressing the problem of Water Scarcity

If water is available in abundance and at an absurdly low cost, there is usually a tendency to use it carelessly. Along with the measures towards pollution abatement, it is imperative to further intensify our efforts for conservation of water to prevent ground water depletion. The consumer has little incentive to conserve water, as water tariffs are very low. In addition to appropriate pricing of water to reduce water demand in the household sector, there is also a need to develop and implement such cost-effective water appliances as low-flow cisterns and faucets and formulate citizen forum groups to encourage and raise awareness of water conservation.

There is a need to develop new surface irrigation sources and take measures for rainwater harvesting and preventing water run-off. This requires change in regulations, public campaigns, revival of traditional practices of rainwater

harvesting and water conservation in every use. The primary treatment of the sullage from kitchens and bathing activities at RWA level and recirculating it for flushing the toilets and gardening should be encouraged. Incentives should be given to development of cost effective technologies for as much of recycling and reuse at local level as possible.

Regulation of groundwater abstraction

A proper legal framework for regulating withdrawals of groundwater is not in place. Though efforts have been made to check the overexploitation of groundwater through licensing, credit or electricity restrictions, these restrictions are directed only at the creation of wells. The licenses do not even monitor or regulate the quantum of water extracted. Comprehensive new legislation to govern the groundwater abstraction is an imperative. Some of the measures are discussed in the next section.

Water Conservation

Water conservation has to be actively promoted through new policies and regulations. Some of the practices that could be encouraged are:

1) *Conservation in Domestic Use:*

- Regulation by metering and pricing for cost recovery
- Technical improvements such as reduction in distribution losses, promotion of reuse, recycling of wastewater (grey water) for flushing, car washing, plant watering etc.

2) *Conservation in Industrial Use*

- Regulation by metering and pricing,
- Technical improvements such as promotion of reuse, recycling of wastewater after treatment in processes, gardening, cooling, and for flushing toilets etc

3) *Conservation in Irrigation*

- Regulation by volumetric (based on per unit area irrigated) pricing.
- Reduction of crop water demands by promoting IWMI's method for irrigating rice and drip irrigation for water intensive crops like sugarcane present in large command areas in the Rajasthan.
- Technical improvements such as improved irrigation practices (sprinklers etc), reduction in distribution losses etc
- Regulatory measures like imposition of heavy excise duty and taxes for use of pumps beyond one Horse Power for irrigation and domestic purpose. This will also help to replenish the ground water table.

4) *Water Resources Management at Panchayat Raj Institutions Level (Hiware Bazar Model)*

- Effective structures for rainwater harvesting
- Proper accounting of water on annual basis (water budget of a village)
- Annual Water allocation for different uses and users
- Effective Monitoring of Compliance
- Awareness on water conservation

19.8.7 Policy Reforms for Drinking Water Supply Sector

- Transformation of the water sector into a commercially viable operation
- Independent regulator to free the sector from political intervention
- Increasing tariffs to recover full operation and maintenance cost
- Full cost recovery for financial sustainability
- Elimination of subsidies
- Cutting supplies on non-payment (or progressive penalties for non-payment or delayed payment)
- Retrenchment of inappropriate staff and reduction of unnecessary expenses.
- Privatization and Public-Private Partnerships (PPPs) where appropriate
- Allocation of water to highest value use through market mechanism while ensuring the minimum needs of the poor through cross-subsidization.

19.8.8 Policy for Industrial Water Use

- All water abstractions (surface and groundwater) need to be properly metered and appropriately priced to recover full O&M and capital costs.
- Provision for incentive for water conservation (cess rebate, award schemes), especially reducing water consumption per unit production, by reducing wastage, reuse of wastewater, recycling of water.
- Compulsory rainwater harvesting in all industrial units and commercial complexes.
- Every industry should harvest rainwater and store it for its uses or recharge ground water to the extent groundwater is abstracted by it. This should be made mandatory by law.
- Awareness campaigns among the workers for water conservation in industry and at household level.

19.8.9 Policy for Environmental Flows in Rajasthan

A minimum quality, quantity and distribution of water are required to maintain the components, functions and processes of aquatic ecosystems thriving in the river. Due to heavy abstraction of surface and groundwater in the catchment area of the rivers in Rajasthan, the rivers and their many tributaries remain dry for considerable period in a year. This has resulted in heavy losses of biological resources. In order to maintain the environmental flows in these rivers, it is important that water resources are optimally managed and augmented to the extent necessary in the entire basin, including groundwater recharging, village ponds, water conservation, recycling of wastewater and economy in water use.

Figure 13.1

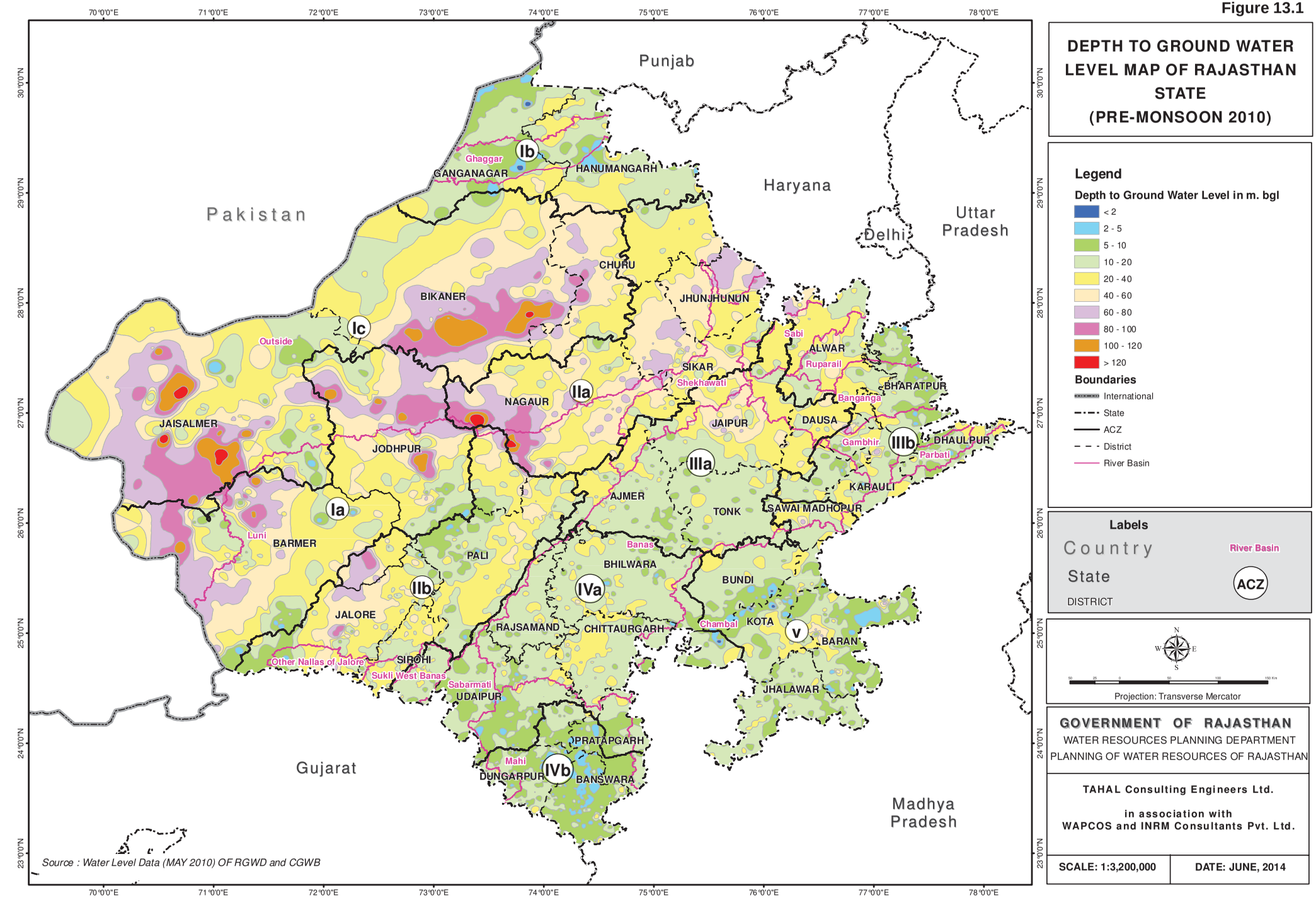
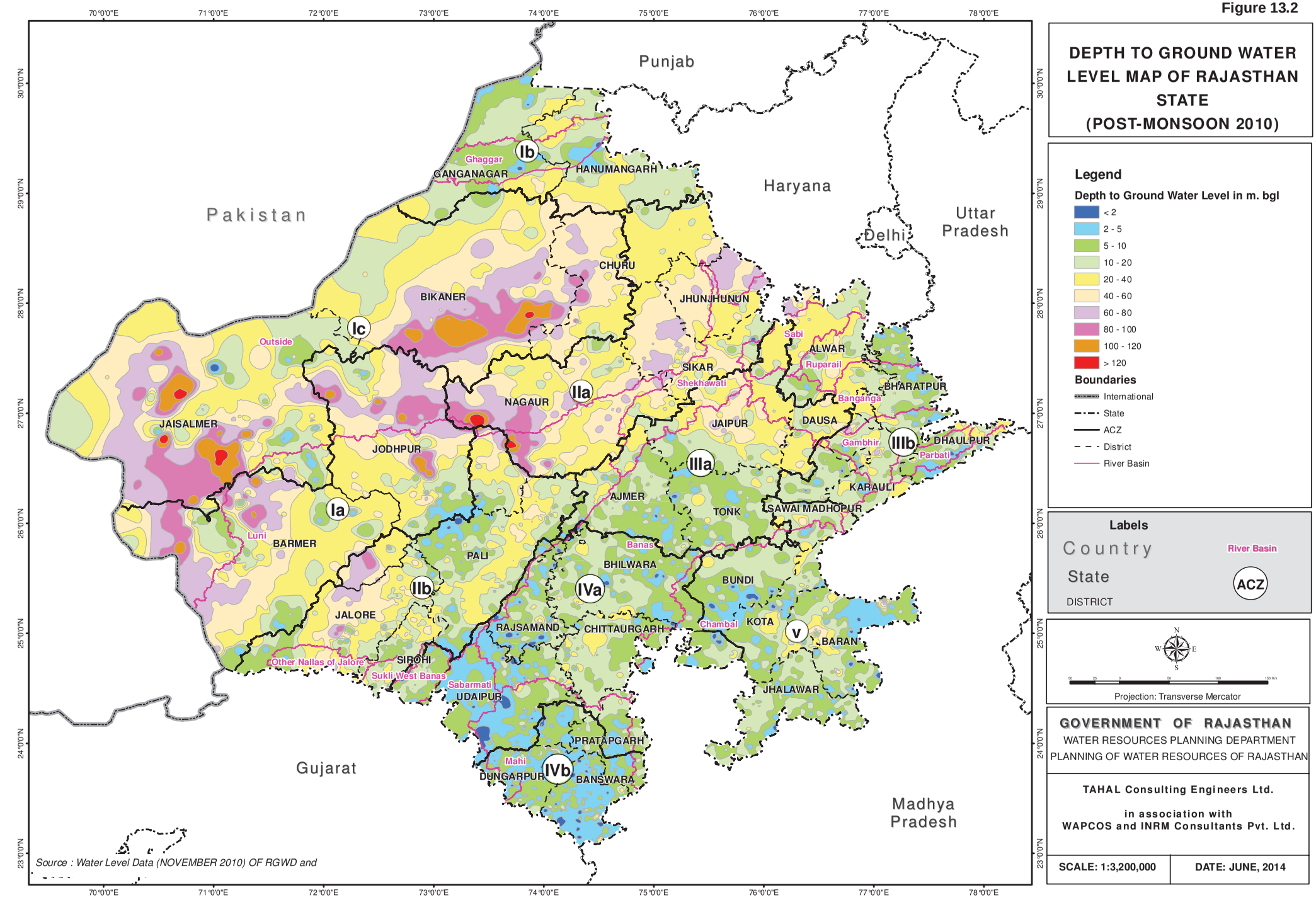

DEPTH TO GROUND WATER LEVEL MAP OF RAJASTHAN STATE (PRE-MONSOON 2010)
Legend
Depth to Ground Water Level in m. bgl
< 2
2 - 5
5 - 10
10 - 20
20 - 40
40 - 60
60 - 80
80 - 100
100 - 120
> 120
Boundaries
International
State
ACZ
District
River Basin
Labels
Country
State
DISTRICT
River Basin
ACZ
Projection: Transverse Mercator
GOVERNMENT OF RAJASTHAN
WATER RESOURCES PLANNING DEPARTMENT
PLANNING OF WATER RESOURCES OF RAJASTHAN
TAHAL Consulting Engineers Ltd.
in association with
WAPCOS and INRM Consultants Pvt. Ltd.
SCALE: 1:3,200,000
DATE: JUNE, 2014
Punjab
Haryana
Uttar Pradesh
Delhi
Pakistan
Gujarat
Madhya Pradesh
Ib
Ic
IIa
IIb
IIIa
IIIb
IVa
IVb
Ia
V
GANGANAGAR
HANUMANGARH
BIKANER
CHURU
JHUNJHUNUN
NAGAUR
SIKAR
ALWAR
BHARATPUR
JAISALMER
JODHPUR
JAIPUR
DAUSA
DHAULPUR
AJMER
TONK
SAWAI MADHOPUR
KARAULI
BARMER
PALI
BHILWARA
BUNDI
JALORE
RAJSAMAND
CHITTAURGARH
KOTA
BARAN
SIROHI
UDAIPUR
JHALAWAR
PRATAPGARH
DUNGARPUR
BANSWARA
Ghaggar
Outside
Sabi
Ruparail
Shekhawati
Banganga
Gambhir
Parbati
Luni
Banas
Chambal
Other Nallas of Jalore
Sukli
West Banas
Sabarmati
Mahi
Source : Water Level Data (MAY 2010) OF RGWD and CGWB

Figure 13.2


DEPTH TO GROUND WATER LEVEL MAP OF RAJASTHAN STATE (POST-MONSOON 2010)
Legend
Depth to Ground Water Level in m. bgl
< 2
2 - 5
5 - 10
10 - 20
20 - 40
40 - 60
60 - 80
80 - 100
100 - 120
> 120
Boundaries
International
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Punjab
Haryana
Uttar Pradesh
Delhi
Pakistan
Gujarat
Madhya Pradesh
Ib
Ic
IIa
IIb
IIIa
IIIb
Ia
IVa
IVb
V
GANGANAGAR
HANUMANGARH
Ghaggar
BIKANER
CHURU
JHUNJHUNUN
Outside
NAGAUR
SIKAR
Shekhawati
ALWAR
Sabi
Ruparail
BHARATPUR
Banganga
JAISALMER
JODHPUR
JAIPUR
DAUSA
DHAULPUR
Parbati
Gambhir
KARAULI
AJMER
TONK
SAWAI MADHOPUR
Luni
BARMER
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Banas
BHILWARA
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JALORE
RAJSAMAND
CHITTAURGARH
Chambal
KOTA
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Other Nallas of Jalore
SIROHI
Sukli
West Banas
Sabarmati
UDAIPUR
JHALAWAR
PRATAPGARH
Mahi
DUNGARPUR
BANSWARA
Source : Water Level Data (NOVEMBER 2010) OF RGWD and

Final Report No. 4.9

Volume 2 of 3

Appendices

Appendix 1 – Review of Earlier Studies

1.1 Review of Earlier Studies

1.1.1 State Water Resources Planning Department, State Water Policy, February 2010

The State Water Policy addresses the following issues:

- Growing imbalance between water demand and supply.
- Uncertainty of the water availability.
- Inequity to the water access.
- Low operational efficiency of the water resources systems.
- Groundwater depletion and its quality deterioration.
- Ownership lack amongst stakeholders.

The approach to formulate the required policy in order to solve the above mentioned issues is summarized by referring to major topics as follows:

- Water Allocation Priorities.
- Optimizing water availability separately dealing with surface and ground water resources with special reference to basin, sub-basin, aquifer and State-level water resources development and environmental plans will be prepared with the stakeholders participation.
- Project planning and implementation including future water demand, integration of surface and ground water resources and their environmental impacts.
- Inter-basin and inter-sub-basin water transfer.
- Command area development works.
- Integrated water resources management with special reference to organization and participation of water users, resourcing of water users groups, technical backup and assistance at community level.
- Irrigation water with special reference to irrigation practices including agricultural research.
- Water resources infrastructure with special reference to data collection and dissemination and management of information system, efficiency, maintenance and safety of structures, drainage and salinity, urban water supply and sewerage.
- Water conservation: general, urban, municipal and industrial, rural and agricultural, groundwater.
- Water quality including sewage effluents.
- Environmental management.
- Drought management.
- Water pricing.
- Legal enablement.
- Institutional capacity building and restructuring state-wide and communal.
- Research.

1.1.2 Vyas Committee (2010), Executive Summary of Report on Integrated Water Resources Development in Rajasthan

The available water supply is short of the state's requirements by some 8 Bm^3 (billion cubic metres) at present, which will go up to 9 Bm^3 by 2015. Natural Monsoon precipitation averages 590 mm in the State, but varies widely from region to region and year to year. The bulk of it is lost due to run offs or evaporation. There are no perennial rivers. A large part of State's water supply is through inter-state flow of water, which adds a political dimension to the problem. As the experience all over the country suggests, riparian states try to pre-empt the water to meet with their own growing needs. Excessive dependence on progressively dwindling ground water resources with continuously rising cost of extraction is another serious difficulty.

The problem of drinking water in Rajasthan is particularly acute. The current demand of about 2.5 Bm^3 for this purpose is likely to double in the next 40 years. Another 2.0 Bm^3 will be needed in that year for cattle for drinking purposes as well. Rapid population growth, rising demand, neglect of old traditional sources, silting of reservoirs, change in land use, etc. have shrunk the availability of water resources during the last few decades. Consequently, ground water resources have been over-exploited and their quality has also deteriorated. All these factors have affected sustainability of sources for drinking water supply.

The cost of supplying drinking water is rapidly increasing, as local sources are either not available or not adequate, causing water to be conveyed over long distances.

Irrigation claims the lion's share, over 80 per cent, of the available water supply in Rajasthan, as it does elsewhere in the country. It is also among the worst offenders in terms of losses and inefficiency.

Administration of the water sector in Rajasthan, as in other states of the country, suffers from many defects. These include widening of the government role and consequent shrinking of the role of the community; attendant bureaucratization, marked by a hierarchical, top-down, and fragmentary approach; profusion of departments and agencies with limited co-ordination among them; simultaneous pursuit of development, management and regulation, with emphasis on development and neglect of maintenance, which affects efficiency and reduces accountability. The administration is not people friendly, its approach fragmentary and its competence lop-sided.

The committee's main recommendations were as follows:

- Water must be seen in an integrated and holistic manner, with a clear understanding of the mission, objectives and areas of strategic intervention.
- In view of the finite availability of and growing demand for water, the state water policy should advocate an integrated approach and prioritize various activities. All sources of water, surface and ground, must be reckoned

together, as should its uses, for drinking, irrigation, industrial and other purposes, rather than treating each fragment as an entity of its own.

- Planning of water resources should be based on dependable information at the river basin (or canal or aquifer) level and coordinated at the state level.
- Conjunctive use of surface and ground water, requiring careful regulation of extraction and monitoring of both these sources and their integrated utilization, facilitated through appropriate and rational pricing of water will be crucial strategic interventions.
- Since the water availability cannot be increased in the State of Rajasthan, it is recommended to take measures such as rain water harvesting, expeditious completion of projects under implementation, harnessing untapped potential and full utilization of potential already created, re-charging ground water in a campaign mode, reducing evaporation losses, recycling the used water and, above all, saving of water by more efficient ways of conveyance and application all become important means of conserving supplies.
- The dependence of the State of Rajasthan on groundwater resources and their deterioration and quality degradation lead to the recommendation to apply techniques such as reverse osmosis, electro-dialysis, flash distillation and artificial recharge.
- The communities' usufruct rights for a given aquifer must be recognized, and accompanied by dependable information on the availability of ground water resources in the given aquifer.
- It is recommended to perform a massive campaign to educate the people regarding the severity of the water crisis and criticality of suggested actions.
- A review exercise for each drinking water supply scheme to estimate demand of water for drinking and other civic uses for the next 10 to 20 years is needed to ensure its sustainability.
- The norms for urban water supply need to be revised downwards to ensure that there is some parity between urban and rural availabilities and the supply is stretched to meet the requirements.
- While the government could bear water supply capital costs, users should bear the operating costs. Poorer sections, however, should be provided targeted subsidies to ensure that paucity of means does not imply denial of access to water.
- To optimize irrigation water uses it is required to rectify the current situation and to manage the resource judiciously in the future to ensure its optimal use. A mix of policy, technological, agronomic, and economic measures is required. The existing poor efficiency of canal irrigation needs to be improved by emphasizing maintenance. Formation of Water Users' Associations and their involvement in various operational and management tasks is essential for improving the water use efficiency and effecting savings of water and expenses.
- Water allocation priorities are drinking water, irrigation, power generation, industry, tourism and other uses in that order. Allocations for the water sector must at least be protected if not increased in view of the dire situation.
- The situation needs to be rectified at all levels and along many dimensions. At the ground level, Water Users Associations (WUAs) need to be strengthened and enabled to take on increasing roles in the planning and

operation of specific projects in their areas. This must form the foundation of the administrative structure. They must receive adequate technical and managerial support to be truly effective. Basin level committees should be formed and given adequate technical and financial resources to manage their areas. These would help fill the gap between the ground level and the state. A state-level water resources development organization with multi-disciplinary staff should be set up. This department will take on the tasks which are presently distributed among many different ones with diverse interests and thus help achieve integration.

- The State Water Policy would be enforceable only if it is backed by comprehensive and updated water legislation.
- It is recommended that Non Governmental Organizations (NGOs) would play a pivotal role in mobilizing and organizing them as well as enhancing their capacity for undertaking the various tasks. All the recommendations concerning registration of NGOs, identification, screening of projects, technical approval, various sanctions, fund release, etc must be time-bound and transparent without compromising the quality of the projects and works. The intention is not to create one more category of civil contractors or to curb any existing good treatment offered to the reputed NGOs in entrusting the works. The main purpose is to facilitate people's participation in this extremely important task by institutions that are closer to people and are capable of empowering them.
- It is recommended to improve People's Participation by provision and strengthening of effective participatory management. Similarly, the involvement of the constitutional Panchayat Raj Institutions (PRIs) in water budgeting and auditing would help the improvement of people's participation.
- It may be necessary to put a moratorium on digging wells not just in the dark zones, but even in other areas where paucity of ground water is imminent. It is necessary to put in an obligation of recharge on well owners. Restrictive regulations, such as prohibition on digging wells in command area of canals, may be withdrawn.
- Drinking water should be considered a 'natural' good and a minimum supply of drinking water should be available to every citizen as a matter of right. The state should reimburse the public authority responsible for supplying drinking water to truly indigent sections. Rationalization of irrigation dues between crops and between regions and the charges levied on drinking water with different quantum of availability need priority attention.

1.1.3 International Commission on Irrigation and Drainage (2005), Water Resources Assessment of Sabarmati River Basin, India

Sabarmati basin (see Figure 1.1) is a water deficit basin having intensive agriculture, industrial development and high population density as can be seen from the information given by the following table.

Drainage area	**21,565 km^2 (17,441 km^2 in Gujarat state and 4,124 km^2 in Rajasthan state) Average annual rainfall 750 mm**
Annual renewable water resources	**3,810 Mm^3**
Per capita water availability/year	**324 m^3**
Gross cropped area	**1.5 Mha (million hectares)**
Irrigated area	**1.13 Mha (0.43 Mha surface and 0.7 Mha groundwater irrigated)**
Present population	**11.75 Million (51% urban)**
Projected population in 2025	**19.86 Million**
Inter-basin water import	**• Present - 1580 Mm^3 • Planned - 2138 Mm^3**

A monthly rainfall – runoff model was calibrated and applied to check for various water use scenarios.

Scenarios Examined

Business as Usual (B as U), and following alternative future (2025) scenarios:

- Irrigation expansion, but no Import of water from Narmada basin.
- As per the Gujarat Govt. proposal for water infrastructure development including pumping of Narmada waters in the upper reservoirs, and increase in in-basin use, imports and exports.
- Lesser import and export of water.
- Irrigation expansion and agricultural seasonal shift.
- Reduction of groundwater use and in the pumping of Narmada waters into the reservoirs
- Reduction of groundwater use by lesser irrigation expansion and better management.
- Limited agriculture shift and water exports.

Key Findings

- Amount of non-beneficial ET in the nature and agriculture sectors is almost same as the annual river flow.
- Reduction of non-beneficial ET through appropriate soil and water management can be a potential strategy.
- Import of Narmada water is necessary to sustain the present withdrawals, meet the future needs and for improvement of low flows to maintain river ecology.
- Present groundwater use is unsustainable.
- Large-scale artificial recharge to groundwater or a significant reduction in groundwater and the total use is warranted.

Figure 1.1: Sabarmati River Basin

1.1.4 Narain, P., Khan, M. A., Singh, G. (2005), Potential for Water Conservation and Harvesting against Drought in Rajasthan, India, Working Paper 104, Drought Series: Paper 7, IWMI

This study examines the potential for water harvesting and conservation against drought in the Indian state of Rajasthan. It indicates that despite water resources depletion, the state still has significant potential for harvesting and conserving water if an integrated water resources management approach is adopted, and proper policies and investment actions are implemented using recent technologies. The study suggests the following promising components of the water harvesting and conservation potential of the state.

- Rajasthan has about 50 million hectares of rocky/stony terrain. Over the existing storage, it offers the possibility of harvesting and conserving 90 -

145 million cubic meters (Mm^3) of runoff annually by developing suitable rainwater harvesting structures.

- Many additional sites have been identified for traditional water harvesting systems throughout the state and, when developed, they can satisfy the water requirements of large populations.
- A case study in Jodhpur district has shown that with the existing and proposed rainwater harvesting structures, over 68 Mm^3 of water will be available even during severe drought, which may suffice to meet nearly 69 percent of the drinking water requirement of villages.
- Multiple existing tanks/reservoirs for storage and conservation of runoff need urgent
- Rehabilitation could lead to additional storage that could be utilized in dry years.
- The state has 216 cities, which generate 522 Mm^3 of utilizable roof runoff annually.
- Excluding losses, a potential of 265 Mm^3 of runoff from roof surfaces is available from urban catchments for harvesting and conservation in underground cisterns or for recharging groundwater aquifer through bore wells, to mitigate drought. This could meet the domestic water requirements of nearly 9 million people.
- High flash floods, though occurring once in about 10 years, can bring as much as 22.6 - 54.8 billion cubic meters (Bm^3) of additional water in one year. This is comparable to 55.7 Bm^3 of free underground storage, accumulated in the state during the last 20 years due to groundwater exploitation. Taming the excess flood water to rejuvenate the depleted aquifer is a major financial and technological challenge
- Surplus water of the Indira Gandhi Canal may also be utilized to recharge the depleted aquifers.
- In-situ water conservation on vast arable lands, recharging of the soil profile, runoff harvesting and its efficient and economic utilization through drip, sprinkler or conservation irrigation are vital for drought mitigation.
- It is estimated that one year's drought-relief funds may be sufficient to develop rainwater harvesting structures to meet drinking water requirement in rural areas of western Rajasthan.

This study has presented the following information:

- An Isohyets Map of The State (see Figure 1.2),
- Basin-Wise Water Resources Potential For The Year 2004
- The 2004 Status of Reservoirs And Tanks With Capacity Exceeding 4.5 Mm^3,
- Groundwater Resources Potential of The State in January 2004 and
- Groundwater Recharge Potential of Rajasthan, base year 1984.

Figure 1.2: Isohyets Map of the State of Rajasthan

Basin-wise Water Resources Potential (2004)
According the 2005 study by Narain, Khan and Singh

River basin	Area (km^2)	Population (million)	Available water resources (BDM)	Per capita water availability (m^3 per year)
Chambal	33,849	7.03	12.64	1,798
Mahi	16,985	4.15	4.65	1,120
Luni	38,310	5.99	3.14	524
Sabarmati	4,164	0.59	1.02	1,729
Banas	47,600	12.87	6.75	525
Banganga	12,763	5.12	0.97	190
Gambhir	4,173	5.17	2.23	431
Internal drainage (outside of the basin)	168,431	17.28	16.61	961
Total	342,239	58.20	48.01	825*

* Average per capita water availability

The Status of Reservoirs and Tanks with Capacity Exceeding 4.5 Mm^3
(2004)
According the 2005 study by Narain, Khan and Singh

No.	Capacity range (MCM)	No. of reservoirs and tanks	Total water storage (BMC)	Available water during dry period (BMC)
1	>150	7	10.17	9.17
2	100-150	3	0.36	0.22
3	50-99.9	20	1.05	0.84
4	25-49.99	20	0.69	0.41
5	10-24.99	49	0.77	0.46
6	5-9.99	80	0.56	0.34
7	<5	26	0.12	0.07
	Total	**203**	**13.72**	**11.51**

Groundwater Resources Potential of Rajasthan in 01 January 2004
According the 2005 study by Narain, Khan and Singh

District	Net annual groundwater availability (MCM)	Actual groundwater availability exploitation (MCM)	Present groundwater balance (MCM)	Stage of groundwater development (%)
Ajmer	314.42	348.82	-34.40	110.94
Alwar	912.30	1112.07	-199.77	121.9
Banswara	162.50	39.21	123.30	24.13
Baran	495.31	321.99	173.31	65.01
Barmer	249.80	255.91	-6.10	102.44
Bharatpur	514.26	479.66	34.60	93.27
Bhilwara	426.79	450.38	-23.59	105.53
Bikaner	197.61	144.52	53.09	73.13
Bundi	355.70	232.12	123.58	65.26
Chittorgarh	460.11	519.48	-59.37	112.9
Churu	197.69	117.35	80.34	59.36
Dausa	268.01	295.30	-26.29	109.77
Dholpur	237.21	245.80	-8.58	103.62
Dungarpur	92.78	76.53	16.26	82.48
Ganganagar	198.83	133.51	65.28	67.17
Hanumangarh	194.61	166.67	27.94	85.64
Jaipur	684.41	1015.99	-331.58	148.45
Jaisalmer	52.59	39.60	13.00	75.29
Jalor	423.61	827.48	-403.86	195.34
Jhalawar	397.70	381.24	16.46	95.86
Jhunjhunu	243.04	419.68	-176.64	172.68
Jodhpur	393.13	660.87	267.74	168.1
Karauli	412.66	340.81	71.85	82.59
Kota	404.10	220.80	183.30	54.64

District	Net annual groundwater availability (MCM)	Actual groundwater availability exploitation (MCM)	Present groundwater balance (MCM)	Stage of groundwater development (%)
Nagaur	628.16	842.14	-213.98	134.07
Pali	413.39	330.34	83.05	79.91
Rajsamand	154.19	143.62	10.56	93.15
S. Madhopur	384.70	311.54	73.17	80.98
Sikar	324.52	344.70	-20.17	106.22
Sirohi	265.65	247.37	18.28	93.12
Tonk	414.53	270.67	143.86	65.3
Udaipur	283.63	298.58	-14.95	105.27
Total	**11,158.97**	**11,634.78**	**-475.8**	
Average				**104.3**

Groundwater Recharge Potential of Rajasthan (base year 1984)
According the 2005 study by Narain, Khan and Singh

District	Geographical area (km^2)	Potential zone (km^2)	Average groundwater depletion in 1984-2003 (m)	Net space available for recharge (MCM)	Net storable flood water in 10 year (MCM)
Ajmer	8,481.00	7,466.76	-3.04	406.18	79.85
Alwar	8,720.46	6,825.81	-4.34	2,027.81	398.66
Banswara	5,037.00	4,288.92	-4.14	329.24	64.73
Baran	6,955.31	6,892.21	-5.12	1,429.23	280.98
Barmer	28,387.00	12,734.65	-3.18	2,147.50	422.19
Bharatpur	5,044.10	3,412.52	-4.27	846.42	166.40
Bhilwara	10,455.00	9,354.85	-6.38	981.06	192.87
Bundi	5,500.00	4,240.18	-10.34	1,695.42	333.32
Chittorgarh	10,856.00	8,277.87	-6.87	1,247.18	245.19
Churu	16,830.00	7,895.62	-0.98	466.81	91.77
Dausa	3,420.17	3,085.62	-8.65	1,538.98	302.56
Dholpur	3,009.05	2,049.90	-4.90	527.34	103.67
Dungarpur	3,770.00	2,634.13	-4.00	160.11	31.48
Jaipur	11,061.00	9,994.67	-10.55	5654.07	1,111.57
Jaisalmer	38,401.00	9,868.30	-0.18	90.45	17.78
Jalor	10,640.00	8,228.10	-10.17	5,050.02	992.82
Jhalawar	6,219.00	6,106.16	-4.49	632.11	124.27
Jhunjhunu	5,928.00	5,273.69	-9.14	2,436.63	479.04
Jodhpur	22,250.00	18,867.92	-9.08	7,513.80	1,477.22
Karauli	5,038.60	3,902.42	-8.09	1,619.25	318.34
Kota	5,203.94	5,123.17	-6.39	1,801.45	354.16
Nagaur	17,718.25	16,378.50	-8.68	6,805.78	1,338.00
Pali	12,357.00	7,362.54	-10.11	2,315.53	455.23

District	Geographical area (km^2)	Potential zone (km^2)	Average groundwater depletion in 1984-2003 (m)	Net space available for recharge (MCM)	Net storable flood water in 10 year (MCM)
Rajsamand	4,635.46	3,540.09	-7.09	376.49	74.02
S. Madhopur	5,020.65	4,325.63	-6.79	1,326.38	260.76
Sikar	7,880.85	7,273.46	-8.39	3,273.66	643.59
Sirohi	5,136.00	4,075.70	-8.66	1,216.38	239.14
Tonk	7,200.00	6,525.72	-8.77	1,374.56	270.24
Udaipur	12,643.54	8,229.48	-3.64	458.54	90.15
Total				55,748.38	10,960.00

1.1.5 Ministry of Water Resources, Central Water Commission (2006), Integrated Hydrological Data Book

This hydrologic yearbook (as the yearbooks of 2007 and 2008) presents some information referred to 4 rivers of the State of Rajasthan namely, Mahi, Luni, Sabarmati and Banas.

The following information is presented: general location description, drainage area of the river and its major tributaries, range of temperatures over the watershed, mean annual rainfall and type and number of hydrometric stations. More detailed information is related to the recorded Monsoon, non-Monsoon annual stream flows in the period 1986/87-1996/97 in each of the hydrometric stations. Similar information is referred to sediment loads (also monthly and decadal means) and to water quality parameters (mean values).

Another sort of information refers to land utilization patterns, gross and net irrigated areas using the abovementioned river waters state-wise.

1.1.6 Ministry of Water Resources, Central Water Commission (2009), Integrated Hydrological Data Book

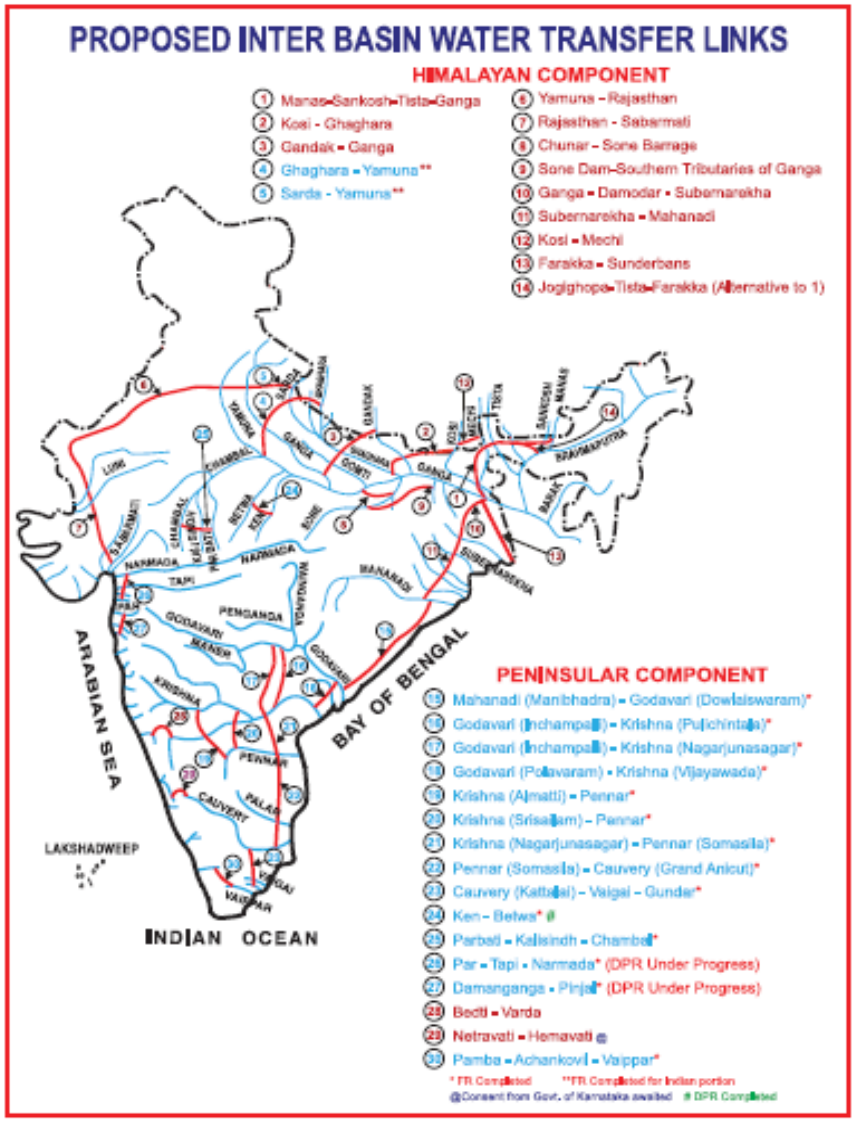
The following information with reference to Mahi and Sabarmati rivers hydrologic stations is presented (observation periods vary):

- Maximum and minimum water levels and discharge values
- Annual dependable stream flows
- Ten daily and monthly mean sediment load
- Water quality parameters
- Land utilization pattern by river basin and state
- Gross and net irrigated area by river basin and state

1.1.7 Ministry of Water Resources, National Water Development Agency (2009), Annual Report 2008-09

This report presents the proposed inter-basin water transfer links in the territory of India (see Figure 1.3). Two projects that refer to Rajasthan, namely Yamuna-Rajasthan and Rajasthan-Sabarmati are mentioned.

Figure 1.3: Schematic Presentation of Inter-Basin Water Transfer Links in the Indian Sub-Continent



1.1.8 Government of Rajasthan, Rural Development and Panchayati Raj Department (2010), Report on "Environmental Assessment Study and Development of Environmental Management Framework for Rajasthan Rural Livelihood Project", The Energy and resources Institute, Pub. No. E2583 V2

The report summarizes the following information for 15 districts in Rajasthan:

- Agro-climatic zone
- Total blocks, Total number of villages
- Mean annual rainfall
- Average annual means of max. and min. temperatures
- Major crops
- Type of soils

It also gives general information referred to surface and groundwater resources and to source-wise irrigated areas in these districts. One table also presents source-wise irrigated areas in the project districts.

Basin-wise Availability of Surface water (Mm^3)

Basin	Main availability	Water availability at 50% dependability	Unutilizable water at 50% dependability	Economically utilizable water at 50% dependability	Net water availability for planning at 50% dependability
	8	9	10	11	12
Shekhawati	221	160.7	56	104.7	14.98
Ruparail	210	201.5	22	179.5	77.86
Banganga	569	516.2	67	449.2	36.94
Gambhir	805	550.3	197	353.3	121.74
Parwati	226	182.1	44	138.1	-17.18
Sabi	268	223.3	55	168.3	60.65
Banas	4837	4039.3	0	4039.3	399.54
Chambal	11541	10053	4850	5203	2296.23
Mahi	3755	3149	0	3143	422.41
Sabarmati	960	799.9	0	799.9	599.86
Luni	1224	820.8	369	451.8	-684.86
West Banas	551	406.1	0	406.1	327.1
Sukli	190	111.7	0	111.7	67.41
Other Nala	91	31.6	0	31.6	31.6
Outside	483	468	0	468	459
Total	25,931	21,713.5	5660	16,053.5	4211.23

Source: State Water Resources Planning Department

Note:
8.Total resource in the basin/region
9.Water available in the basin/region in a situation wherein 50% of the resource is being used/depleted
10.Water which is not potable in the basin/region wherein 50% of the total resource available is being used

11. Water available for the economic development and well being of the society when 50%of available resource is being used
12.Wherein 50% of used of the total available resource

Basin-wise Availability of Groundwater

Basin	Potential zone (sq.km.)	Net annual availability	Gross for irrigation	Gross for domestic/industrial use	Gross for all use	Allocation for dom./indl use as on 2025	Net GW available for irrigation	Stage of GW development %	Category	RRLP districts
Shekhawati	9495.2	503.8462	972.1902	111.5795	1083.7697	243.4481	-468.1225	215.1	over exploited	None
Ruparail	942.3	347.3004	418.6182	55.2695	473.8877	72.2153	-143.533	136.45	over exploited	None
Banganga	6593.35	605.8966	813.9884	90.2855	904.2739	143.8773	-351.969	149.25	over exploited	Dausa, Sawai Madhopur
Gambhir	3615.57	349.2411	409.1767	46.7283	455.9051	73.2904	-133.2261	130.54	over exploited	Dausa, Dholpur, Sawai Madhopur
Parwati	4879.94	153.5688	186.1281	18.0913	204.2194	28.6049	-79.2555	132.98	over exploited	Dholpur, Sawai Madhopur
Sabi	400.48	426.1719	644.216	43.9114	688.1274	64.2581	-282.3022	161.47	over exploited	None
Banas	41089.68	2290.853	2814.7422	389.1081	3203.8503	794.9698	-1318.859	139.85	over exploited	Dausa, Tonk, Bundi, Sawai Madhopur, Udaipur, Rajsamand, Bhilwara, Chittorgarh
Chambal	27751.94	1921.567	1966.2914	135.399	2101.6905	28.2566	-324.9812	109.37	over exploited	Chittorgarh, Bhilwara, Bundi, Sawai Madhopur, Tonk, Kota, Jhalawar, Baran, Dholpur
Mahi	12062.2	528.3994	439.3851	36.8787	476.2732	109.7902	-20.777	90.14	Critical	Banswara, Chittorgarh, Dungarpur, Udaipur
Sabarmati	1056.57	80.4701	65.7375	4.8663	70.6038	20.8108	-3.7772	87.74	Semi critical	Dungarpur, Udaipur
Luni	24547.64	1039.594	1567.0464	119.0169	1686.0633	234.9463	-762.3988	162.18	Over exploited	Rajsamand, Udaipur
West Banas	1186.74	75.5004	64.8149	3.4235	68.2385	6.7468	3.9385	90.38	Critical	None
Sukli	867.2	47.8323	53.0038	0.9764	53.9801	2.0709	-3.9517	112.85	Over exploited	None
Other Nala	1746.51	100.4201	249.778	8.8426	258.6206	15.7973	-165.1552	257.54	Over exploited	None
Outside	80329.77	2063.497	2317.3663	263.1662	2780.5325	688.9201	-942.7896	134.75	Over exploited	Churu, Bikaner

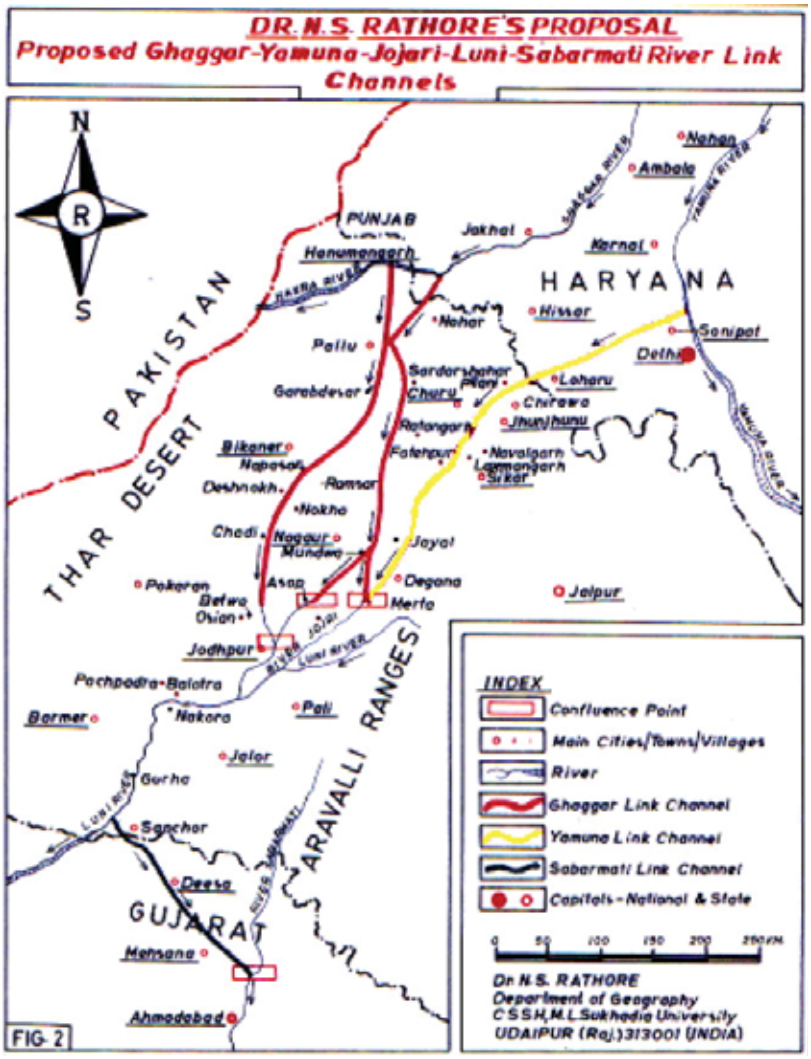
Source-Wise Irrigated Areas in the Project Districts (Ha)

District	Canal		Tank		Well/Tubewell		Other		Total gross irrigation area	Total net irrigation area	Net sown area	% irrigation area w.r.t. net sown area
	Total	Net	Total	Net	Total	Net	Total	Net				
Banswara	48739	47009	6045	5909	16648	15541	16983	16180	88415	84639	239229	35.4
Bhilwara	24545	24528	28531	27893	133165	117271	2224	2084	188465	171776	417819	41.1
Bikaner	140548	95216	8	8	95871	59973	0	0	236427	155197	1160186	13.4
Bundi	136578	114852	398	363	105047	94938	3545	3588	245568	213641	253973	84.1
Chittorgarh	8077	7943	9064	8348	209990	193768	4062	3646	231193	213705	437415	48.9
Churu	0	0	0	0	65102	53828	0	0	65102	53828	1163648	4.6
Dausa	1376	1376	0	0	168918	162515	0	0	170294	163891	214199	76.5
Dholpur	9166	8838	146	146	97452	94630	0	0	106764	103614	148104	70.0
Dungarpur	7910	7447	4557	4049	25146	23495	2804	2504	40417	37495	127753	29.3
Jhalawar	14286	12302	1025	1013	199263	191056	569	564	215143	204935	322859	63.5
Karauli	7550	7539	1205	1205	105366	102699	955	954	115076	112397	191319	58.7
Kota	129597	121818	152	138	111446	104410	6104	6081	2475299	232447	271751	85.9
Rajsamand	0	0	119	119	7414	6226	0	0	7533	6345	100263	6.3
Sawai Madhopur	18918	18918	2886	2883	169459	166980	2959	2959	194222	191740	260892	73.5
Tonk	76028	75737	7123	7113	144926	140251	9144	9088	237221	232189	413557	56.1
Udaipur	11378	11305	9474	9238	52003	49320	1530	1523	74385	71386	268918	26.5

1.1.9 Dr. Rathore's Plan

Rathore, N. S. (2003), Proposed Plan for Satluj – Ghaggar – Yamuna – Jojari – Luni – Sabarmati River Link Channels, Proceedings, Map India 2003. Figure 1.4 presents a scheme of the proposal presented by Dr. Rathore.

Figure 1.4: Proposed Ghaggar-Yamuna-Jojari-Luni-Sabarmati River Link Channels



The presented scheme focus is to harness the water resource potential of a perennial river originating from the Himalayas in order to irrigate the arid and semi-arid part of north-west India. The proposal identifies a new Maru-Ganga river's channel length of about 1,500 Km from Himachal Himalayas to Gulf of Cambay of the Arabian Sea in Gujarat State.

The waters of the Punjab Rivers and also the Yamuna River would be diverted through three link canals: the Ghaggar Link Canal, the Yamuna Link Canal and the Sabarmati Link Canal

Diverting overflows of the Ghaggar and Yamuna Rivers in the rainy season and the Luni River overflows to the Rann of Kachch would reduce downstream flooding and would harness the waters for the region's utilization.

1.1.10 Water Resources Planning for the State of Rajasthan. Tahal Consulting Engineers in Association with WAPCOS (1998)

Summary

This 42-months study (1994-98) covered the following main subjects related to Rajasthan's 14 major River Basins (see Figure 1.5):

- Assessment of surface water yields
- Assessment of groundwater potentials
- Crop water requirements
- Population projections
- Domestic water demand projections
- Water demand by livestock, industries, etc.
- River basin simulation studies
- Irrigation improvement and development planning

The final report of this study includes 15 Water Resources Planning reports, one volume for each river basin, and a 3-Volumes State Water Resources Plan plus 10 volumes of User's Manuals for all the computer models and programs developed by the Consultants.

Figure 1.5: Rajasthan River Basins

1. Shekhawati
2. Ruparail
3. Banganga
4. Gambhir
5. Parbati
6. Sabi
7. Banas
8. Chambal
9. Mahi
10. Sabarmati
11. Luni
12. West Banas
13. Sukli
14. Other Nallahs of Jalore
15. The Outside Basin

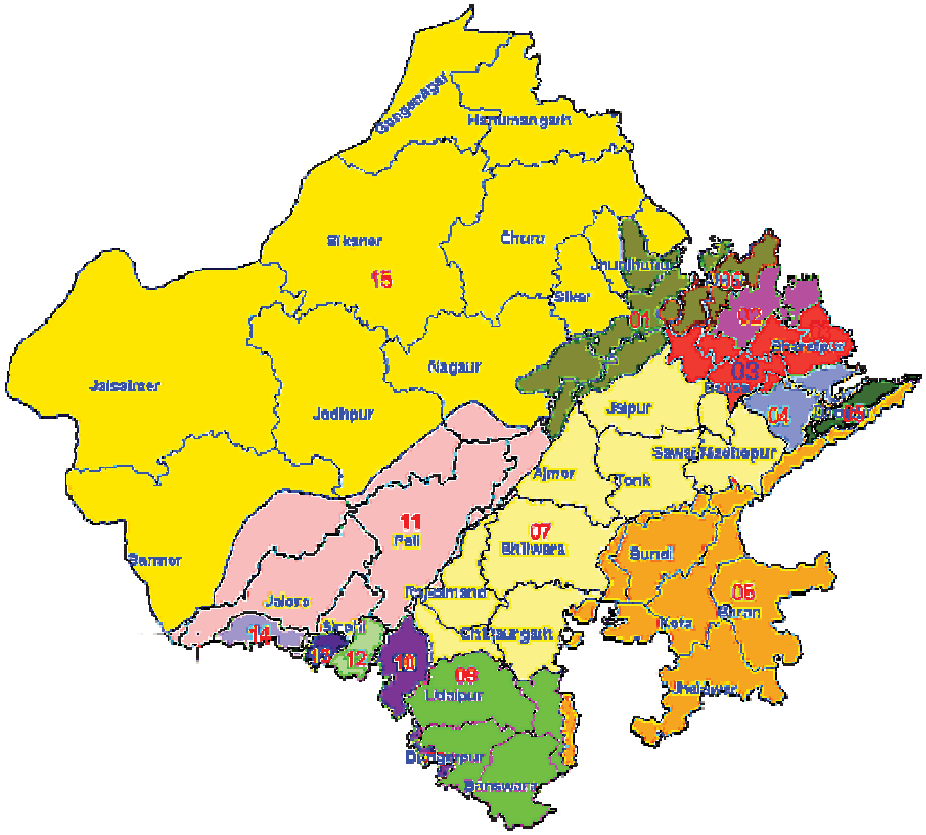


Table 1.1 below summarizes the annual natural surface water yields in the state of Rajasthan as determined by TAHAL & WAPCOS (1998) and Table 1.2 presents the availability of imported water to Rajasthan.

Table 1.1: Summary of Annual Natural Surface Water Yields, Mm^3

River Basin	Mean	Dependability (%)			
		25	50	75	90
Shekhawati	221	282	161	91	53
Ruparail	210	299	202	115	59
Banganga	569	762	516	324	199
Gambhir	805	983	550	315	195
Parbati	226	285	182	117	79
Sabi	268	366	223	126	70
Banas	4,837	5,958	4,039	2,789	2,030
Chambal*	11,541	14,759	10,053	6,723	4,605
Mahi**	3,755	4,830	3,159	2,023	1,341
Sabarmati	960	1281	800	474	282
Luni	1,224	1,628	821	382	178
West Banas	551	726	406	217	119
Sukli	190	240	112	50	24
Other Nallas	91	102	32	9	3
Sub-Total	25,448	32,500	21,245	13,756	9,238
Outside	483	585	468	366	287
Grand Total	25,931	33,085	21,713	14,122	9,525

* Rajasthan's 50% share of the basin yield upstream of Kota Barrage ** Rajasthan's share

Table 1.2: Imported Water Availability for the State of Rajasthan, Mm^3/yr

Source	Mean	Dependability,%			
		25	50	75	90
A. Rivers Ravi-Beas-Sutlej					
IGNP Stage I	4,433	6,018	4,132	3,110	2,645
IGNP Stage II	4,934	6,698	4,598	3,461	2,944
Gang Canal	1,780	1,910	1,740	1,650	1,610
Bhakra Canal	2,109	2,138	2,020	1,863	1,607
Sidhmukh-Nohar Areas	580	621	586	533	466
Sub Total	13,836	17,385	13,076	10,590	9,272
B. River Yamuna	1,119	1,337	1,211	990	885
C. Narmada Canal	767	965	747	617	447
Total	15,722	19,687	15,034	12,197	10,604

The inter-basin transfer of surface water to the state has also affected ground water regime of Rajasthan. The conveyance and application of the canal water has enhanced ground water recharge. The enhanced ground water recharge through canal irrigation has caused water logging and salinity problems at

places. This requires proper planning of the use of surface and ground water. The example of Suratgarh depressions is an eye opener. The majority of perennial and ephemeral rivers are inter-state; the activities in one affects the river regime of the river in another state.

Appendix 2 - Rainfall Stations after Validation

New basin boundaries have been finalised using 90 m SRTM. As per the new basin boundaries, information regarding number of rain gauge stations falling in each basin, which have been validated, is given below. The stations mentioned in this document are the 327 which are used for model simulation in this Study.

Table 1: Number of Raingauges within Various Basins as per New Modified Basin Boundaries

Basin Name	Total No. of Rain Gauges
Banas	92
Banganga	20
Chambal	41
Gambhir	10
Ghaggar	6
Luni	44
Mahi	36
Other Nallahs of Jalore	0
Outside Basin	34
Parbati	4
Ruparail	6
Sabarmati	3
Sabi	9
Shekhawati	12
Sukli	1
West Banas	9

Table 2: List of Screened Rainfall Stations after Validation

WRIS code	Station Name	Latitude	Longitude	Basin Name
196	Moran Sagar *	26°39'48"	76°32'20"	Banas
192	Bamanwas	26°33'27"	76°33'40"	Banas
252	Bansur	27°40'60"	76°20'60"	Sabi
204	Talabshahi *	26°37'60"	77°40'60"	Parbati
200	Bari	26°38'60"	77°35'60"	Parbati
202	Sepau	26°49'00"	77°39'00"	Gambhir
233	Baseri	26°45'00"	77°31'60"	Gambhir
199	Angai *	26°36'00"	77°27'00"	Parbati
203	Sirmathura	26°31'31"	77°21'39"	Parbati
230	Baretha *	26°53'60"	77°22'00"	Gambhir
231	Bayana	26°53'60"	77°16'60"	Gambhir
258	Sodawas *	27°51'41"	76°24'17"	Sabi
253	Behror	27°52'60"	76°16'60"	Shekhawati
193	Bonli	26°19'45"	76°13'37"	Banas
406	Morel Dam *	26°26'48"	76°19'55"	Banas
209	Deeg	27°26'60"	77°19'00"	Banganga
9	Urmila Sagar *	26°38'01"	77°49'55"	Chambal
673	Dholpur (a)	26°41'60"	77°54'00"	Chambal
8	Dholpur	26°41'60"	77°54'00"	Chambal
194	Gangapur City	26°28'43"	76°43'43"	Banas
236	Juggar *	26°43'00"	77°05'60"	Gambhir
235	Hindaun	26°43'00"	77°00'60"	Gambhir
212	Kaman	27°38'60"	77°15'60"	Banganga
238	Karauli	26°30'00"	77°00'60"	Gambhir
245	Kathumbar	27°19'60"	77°04'00"	Banganga
158	Kishangarh	27°49'00"	76°43'00"	Banganga
254	Kishangarh Bas	27°49'00"	76°43'00"	Banganga
255	Kotkasim	28°01'60"	76°43'00"	Sabi
217	Sewar *	27°15'00"	77°20'00"	Banganga
213	Kumher	27°19'00"	77°22'00"	Banganga
244	Govindgarh	27°30'00"	77°00'00"	Ruparail
228	Mahuwa	27°03'00"	76°54'60"	Banganga
256	Mandawar	27°52'00"	76°32'60"	Sabi
214	Nadbai	27°13'00"	77°10'60"	Banganga
219	Weir	27°10'60"	77°10'60"	Banganga
241	Nadoti	26°43'00"	76°43'60"	Gambhir
257	Neemrana	28°00'00"	76°22'60"	Shekhawati
215	Nagar	27°25'00"	77°05'60"	Banganga

WRIS code	Station Name	Latitude	Longitude	Basin Name
382	Sadri *	25°07'00"	73°28'00"	Luni
380	Muthana *	25°13'60"	73°28'00"	Luni
379	Kana *	25°15'49"	73°30'46"	Luni
374	Desuri	25°16'14"	73°35'24"	Luni
348	Jaitaran	26°11'60"	73°57'00"	Luni
543	Jalore	25°30'00"	72°37'00"	Luni
391	Ahore	25°23'00"	72°46'00"	Luni
413	Jaswantpura	24°48'00"	72°28'00"	Luni
365	Jograwas *	25°46'07"	73°34'60"	Luni
371	Hemawas *	25°44'08"	73°22'58"	Luni
363	Baniawas *	25°46'00"	73°31'00"	Luni
372	Pali	25°46'13"	73°19'42"	Luni
360	Raipur Luni *	26°03'00"	74°01'60"	Luni
341	Girinanda *	26°10'60"	74°10'60"	Luni
359	Raipur	26°03'00"	74°01'60"	Luni
548	Reodhar *	24°37'00"	72°31'60"	Sukli
375	Kharda *	25°55'00"	73°14'00"	Luni
547	Sheoganj *	25°08'22"	73°04'04"	Luni
410	Ora *	25°01'00"	72°47'60"	Luni
411	Sirohi	24°52'60"	72°52'00"	Luni
409	Danta *	24°48'00"	72°50'60"	West Banas
349	Meli Tank *	25°45'00"	72°28'00"	Luni
351	Siwana	25°38'60"	72°24'60"	Luni
361	Sardar Samand *	25°58'56"	73°22'58"	Luni
362	Sojat	25°55'56"	73°39'18"	Luni
389	Takhatgarh *	25°19'00"	73°01'00"	Luni
388	Sanderao *	25°20'18"	73°11'11"	Luni
350	Pachpadra	25°55'60"	72°16'00"	Luni
354	Balotra	25°49'60"	72°15'00"	Luni
438	Barmer (a)	25°45'23"	71°24'03"	Luni
439	Barmer	25°45'23"	71°24'03"	Luni
520	Jodhpur *	26°18'00"	73°01'00"	Luni
518	Jodhpur	26°18'00"	73°01'60"	Luni
536	Osian	26°43'00"	72°55'00"	Luni
523	Phalodi (a)	27°07'60"	72°22'00"	Outside Basin
524	Phalodi	27°07'60"	72°22'00"	Outside Basin
443	Sheo	26°10'60"	71°15'00"	Luni
185	Jaipur (a)	26°48'55"	75°46'60"	Banas

WRIS code	Station Name	Latitude	Longitude	Basin Name
541	Pahari	27°42'38"	77°05'05"	Banganga
249	Rajgarh	27°13'00"	76°37'00"	Ruparail
248	Ramgarh	27°34'60"	76°49'00"	Ruparail
234	Rupwas	26°58'60"	77°34'00"	Gambhir
197	Kalisil *	26°15'48"	76°44'36"	Banas
198	Sapotra	26°17'30"	76°45'09"	Banas
206	Ajan *	27°09'57"	77°28'30"	Banganga
208	Bharatpur	27°14'11"	77°27'51"	Banganga
251	Thanagazi	27°25'00"	76°17'60"	Sabi
260	Tijara	27°56'60"	76°50'60"	Sabi
259	Tapukra	28°07'00"	76°49'00"	Sabi
229	Toda Bhim	26°55'00"	76°49'00"	Gambhir
250	Siliserh *	27°31'00"	76°31'60"	Ruparail
243	Alwar	27°34'00"	76°35'60"	Ruparail
247	Malakhera	27°23'29"	76°37'30"	Ruparail
211	Hingota *	27°05'29"	77°02'16"	Banganga
210	Halena *	27°07'00"	77°07'00"	Banganga
444	Bikaner (a)	28°00'00"	73°17'60"	Outside Basin
445	Bikaner	28°01'00"	73°17'60"	Outside Basin
510	Jaisalmer (a)	26°53'60"	70°55'00"	Outside Basin
511	Jaisalmer	26°53'60"	70°55'00"	Outside Basin
447	Kolayat	27°49'22"	72°57'45"	Outside Basin
446	Lunkaransar	28°30'00"	73°45'00"	Outside Basin
449	Nokha	27°32'42"	73°28'54"	Outside Basin
526	Surpura *	27°42'32"	73°26'52"	Outside Basin
456	Sujangarh	27°41'60"	74°28'60"	Outside Basin
64	Mangrol	25°20'01"	76°30'56"	Chambal
59	Atru	24°52'01"	76°39'56"	Chambal
32	Bakani	24°18'02"	76°13'56"	Chambal
60	Baran	25°06'09"	76°29'29"	Chambal
49	Gudha Dam *	25°06'09"	76°29'29"	Chambal
61	Chhabra	24°40'01"	76°50'56"	Chambal
33	Bhimsagar *	24°36'01"	76°31'56"	Chambal
62	Chhipabarod	24°37'01"	76°46'56"	Chambal
25	Gangdhar	23°56'02"	75°35'56"	Chambal
34	Dug	23°56'02"	75°49'56"	Chambal
162	Chandsen *	25°21'01"	75°19'56"	Chambal
48	Bundi	25°27'01"	75°37'56"	Chambal
50	Hindoli	25°35'01"	75°29'56"	Chambal

WRIS code	Station Name	Latitude	Longitude	Basin Name
184	Jaipur	26°54'49"	75°47'04"	Banas
190	Sanganer	26°48'55"	75°46'60"	Banas
426	Chomu	27°10'00"	75°39'60"	Shekhawati
180	Amber	26°58'60"	75°52'00"	Banas
154	Arain	26°26'59"	75°02'44"	Banas
160	Sarwar	26°03'54"	75°01'14"	Banas
220	Baswa	27°08'60"	76°35'00"	Banganga
181	Bassi	26°50'07"	76°03'04"	Banas
155	Bhinai	26°03'06"	74°46'18"	Banas
157	Goela	26°07'18"	74°56'51"	Banas
182	Chaksu	26°36'21"	75°56'44"	Banas
221	Dausa	26°53'60"	76°20'00"	Banganga
127	Moti Sagar *	25°55'00"	75°39'60"	Banas
130	Panwar Sagar *	25°45'00"	75°30'00"	Banas
128	Nasirda *	25°56'41"	75°22'05"	Banas
165	Chhaparwara *	26°37'39"	75°15'53"	Banas
427	Phulera	26°52'60"	75°13'60"	Shekhawati
171	Naraina	26°47'30"	75°12'19"	Banas
222	Jamwa Ramgarh	27°02'43"	76°03'34"	Banganga
343	Beawar *	26°06'00"	74°19'00"	Luni
186	Kanota *	26°52'33"	75°56'34"	Banas
135	Kekri	25°58'00"	75°09'00"	Banas
262	Kotputli	27°43'00"	76°13'00"	Sabi
188	Rahuwas *	26°41'59"	76°20'08"	Banas
187	Lalsot	26°33'39"	76°19'31"	Banas
164	Tordi Sagar*	26°12'32"	75°25'07"	Banas
175	Malpura	26°17'44"	75°22'34"	Banas
163	Lamba Hari Singh *	26°18'17"	75°09'42"	Banas
136	Masuda	26°07'00"	74°31'60"	Banas
179	Niwai	26°21'48"	75°55'38"	Banas
176	Mashi *	26°22'60"	75°45'60"	Banas
159	Nasira Bad	26°17'49"	74°44'12"	Banas
423	Ajmer (a)	26°28'31"	74°39'13"	Luni
424	Ajmer	26°28'31"	74°39'13"	Luni
346	Pushkar	26°28'60"	74°32'60"	Luni
345	Pisangan	26°23'60"	74°30'00"	Luni
344	Mangliawas	26°16'60"	74°30'00"	Luni
173	Phagi	26°34'40"	75°33'36"	Banas
428	Sambhar	26°55'00"	75°09'60"	Shekhawati

WRIS code	Station Name	Latitude	Longitude	Basin Name
65	Pipalda	25°34'01"	76°26'56"	Chambal
36	Jhalawar	24°32'02"	76°09'56"	Chambal
37	Jhalrapatan	24°33'02"	76°08'56"	Chambal
31	Asnawar	24°29'02"	76°20'56"	Chambal
40	Pachpahar	24°24'02"	75°49'56"	Chambal
45	Ramganjmandi	24°38'01"	75°55'56"	Chambal
120	Khandar	26°01'00"	76°37'00"	Banas
21	Mansarowar *	25°59'01"	76°29'56"	Chambal
38	Khanpur	24°44'01"	76°22'56"	Chambal
66	Ummed Sagar *	25°13'01"	76°46'56"	Chambal
63	Kishanganj	25°06'01"	76°38'56"	Chambal
17	Kota Barrage *	25°11'01"	75°49'56"	Chambal
15	Kota A.p. (a)	25°11'01"	75°50'56"	Chambal
26	Aklera	24°25'02"	76°33'56"	Chambal
51	Nainwa	25°48'01"	75°51'56"	Chambal
39	Pirawa	24°09'39"	76°01'41"	Chambal
46	Sangod	24°56'01"	76°16'56"	Chambal
178	Dheel *	26°13'24"	76°07'03"	Banas
122	Sawai Madhopur	26°01'22"	76°21'15"	Banas
12	Digod	25°13'01"	76°04'56"	Chambal
19	Ladpura	25°08'01"	75°41'56"	Chambal
52	Talera	25°20'01"	75°42'56"	Chambal
435	Chirawa	28°13'60"	75°39'00"	Outside Basin
450	Churu (a)	28°18'00"	74°58'00"	Outside Basin
451	Churu	28°18'00"	74°58'00"	Outside Basin
433	Ramgarh Shethan	27°13'60"	75°12'00"	Shekhawati
432	Dantaramgarh	27°15'00"	75°12'00"	Shekhawati
339	Degana	26°53'60"	74°19'00"	Luni
532	Fatehpur	27°58'60"	74°58'00"	Outside Basin
436	Jhunjhunu	28°07'60"	75°22'60"	Outside Basin
420	Khetri	28°00'03"	75°47'17"	Shekhawati
430	Nawa	27°01'00"	75°00'60"	Shekhawati
533	Laxmangarh	27°49'60"	75°01'60"	Outside Basin
529	Ladnu	27°38'60"	74°22'60"	Outside Basin
421	Neem Ka Thana	27°43'60"	75°46'60"	Shekhawati
431	Parbatsar	26°52'00"	74°45'60"	Shekhawati
534	Sikar *	27°37'00"	75°07'60"	Outside Basin
535	Sikar	27°37'00"	75°07'60"	Outside Basin

WRIS code	Station Name	Latitude	Longitude	Basin Name
161	Sri Nagar	26°26'05"	74°46'31"	Banas
156	Gegal	26°31'60"	74°45'00"	Shekhawati
226	Sikrai	26°55'00"	76°42'00"	Banganga
131	Toda Rai Singh	26°01'60"	75°28'60"	Banas
133	Tonk *	26°10'00"	75°47'60"	Banas
132	Tonk	26°10'00"	75°47'60"	Banas
177	Pipalu	26°17'46"	75°43'05"	Banas
577	Galwar *	25°52'01"	76°10'56"	Chambal
58	Galvania Bund *	25°52'01"	76°10'56"	Chambal
263	Paota	27°34'60"	76°05'00"	Sabi
331	Mount Abu (a)	24°36'01"	72°43'04"	West Banas
332	Mount Abu	24°36'01"	72°43'04"	West Banas
325	Abu Road	24°28'60"	72°47'60"	West Banas
73	Amet	25°18'30"	73°54'54"	Banas
148	Patan *	25°54'35"	74°22'08"	Banas
116	Sawar	25°45'00"	74°13'00"	Banas
141	Asind	25°43'60"	74°19'00"	Banas
142	Badnore	25°50'19"	74°16'56"	Banas
143	Banera	25°31'00"	74°40'00"	Banas
86	Badi Sadri	24°26'60"	74°28'60"	Banas
5	Begun	24°59'01"	75°07'57"	Chambal
98	Sandesar *	24°40'00"	74°20'00"	Banas
85	Bhadesar	24°41'60"	74°28'60"	Banas
4	Bhainsrorgarh	24°58'01"	75°31'56"	Chambal
152	Bhim	25°44'17"	74°04'45"	Banas
109	Vallabhnagar *	24°41'60"	74°00'00"	Banas
84	Badgaon *	24°42'26"	74°05'22"	Banas
108	Vallabhnagar	24°41'60"	74°00'00"	Banas
87	Bhopalsagar	24°51'10"	74°12'17"	Banas
280	Chhoti Sadri	24°23'60"	74°42'00"	Mahi
146	Khari Dam *	25°01'60"	74°49'60"	Banas
96	Orai *	25°01'60"	74°50'00"	Banas
89	Chittaurgarh	24°54'03"	74°37'24"	Banas
153	Deo Garh	25°31'44"	73°54'26"	Banas
90	Dungla	24°30'24"	74°19'50"	Banas
92	Gangrar	25°03'00"	74°35'60"	Banas
76	Gogunda	24°45'00"	73°34'00"	Banas
138	Vijaynagar	25°55'00"	74°39'60"	Banas

WRIS code	Station Name	Latitude	Longitude	Basin Name
437	Pilani (a)	28°21'00"	75°35'60"	Outside Basin
422	Udaipur Wati	27°43'22"	75°28'08"	Outside Basin
3	Arnod	23°53'00"	74°45'00"	Mahi
290	Aspur	23°56'60"	74°05'00"	Mahi
297	Sabla	23°51'00"	74°12'00"	Mahi
296	Nithawa	23°55'00"	74°17'60"	Mahi
314	Shergarh	23°19'60"	74°10'00"	Mahi
310	Bagidora	23°25'00"	74°17'60"	Mahi
265	Banswara (a)	23°33'37"	74°26'31"	Mahi
266	Banswara	23°33'37"	74°26'31"	Mahi
294	Dungarpur	23°51'00"	73°43'00"	Mahi
323	Kanba	23°48'51"	73°34'09"	Mahi
292	Dewal	23°55'60"	73°42'00"	Mahi
268	Danpur	23°31'00"	74°43'60"	Mahi
288	Dhariawad	24°06'00"	74°26'58"	Mahi
295	Ganeshpur	23°55'00"	73°54'60"	Mahi
264	Arthuna	23°30'00"	74°05'00"	Mahi
269	Garhi	23°36'00"	74°07'60"	Mahi
273	Loharia	23°46'00"	74°13'60"	Mahi
270	Ghatol	23°46'00"	74°24'60"	Mahi
267	Bhungra	23°40'60"	74°30'60"	Mahi
271	Jagpura	23°52'00"	74°20'60"	Mahi
312	Kushalgarh	23°12'29"	74°26'04"	Mahi
274	Mahi Dam *	23°37'60"	74°33'07"	Mahi
275	Pipalkhunt	23°46'60"	74°35'00"	Mahi
309	Sagwara	23°41'00"	74°01'60"	Mahi
820	Sajjangarh	23°15'33"	74°17'23"	Mahi
305	Salumber	24°01'60"	74°12'00"	Mahi
308	Galiakot	23°33'00"	74°00'00"	Mahi
322	Dhambola	23°36'00"	73°46'00"	Sabarmati
484	Longwala *	29°33'29"	74°05'44"	Outside Basin
458	Anupgarh	29°11'07"	73°12'51"	Ghaggar
507	T.a. Singh *	29°11'41"	74°51'09"	Outside Basin
460	Bhadra	29°07'26"	75°10'00"	Outside Basin
470	Ganganagar (a)	29°55'00"	73°52'60"	Outside Basin
471	Ganganagar	29°55'00"	73°52'60"	Outside Basin
475	Hanumangarh	29°34'60"	74°19'00"	Ghaggar
481	Srikaranpur	29°50'53"	73°27'06"	Outside Basin
490	Padampur	29°42'10"	73°37'43"	Outside Basin

WRIS code	Station Name	Latitude	Longitude	Basin Name
139	Agucha *	25°49'60"	74°42'00"	Banas
149	Sareri *	25°41'51"	74°34'51"	Banas
145	Hurda	25°55'00"	74°40'60"	Banas
117	Jahazpur	25°36'00"	75°16'60"	Banas
125	Deoli	25°45'00"	75°25'00"	Banas
137	Tatgarh	25°41'27"	73°58'11"	Banas
321	Jhadol	24°23'60"	73°29'00"	Sabarmati
94	Kapasan	24°52'60"	74°19'00"	Banas
78	Nathdwara	24°55'00"	73°50'00"	Banas
307	Som Ka Gadar *	24°01'47"	73°37'50"	Mahi
298	Babalwara *	24°05'44"	73°27'42"	Mahi
77	Kherwada	23°58'60"	73°35'60"	Mahi
315	Kotra	24°22'60"	73°10'60"	Sabarmati
69	Kotri	25°25'60"	74°52'60"	Banas
384	Kumbhalgarh	25°10'00"	73°34'00"	Luni
114	Meja Dam *	25°23'36"	74°32'25"	Banas
134	Jawaja	25°37'00"	74°13'00"	Banas
113	Mandal	25°25'60"	74°32'60"	Banas
68	Mandalgarh	25°12'34"	75°05'04"	Banas
53	Bijolia	25°11'10"	75°21'56"	Chambal
104	Udaipur Dabok (a)	24°37'28"	73°51'35"	Banas
99	Bagolia *	24°48'00"	73°50'00"	Banas
102	Maoli	24°49'00"	73°58'60"	Banas
93	Gambhiri *	24°41'60"	74°43'00"	Banas
95	Nimbahera	24°37'00"	74°42'00"	Banas
334	Sarupsagar *	24°52'00"	73°02'60"	West Banas
336	West Banas *	24°42'25"	72°56'07"	West Banas
328	Kadambari *	24°46'60"	73°05'00"	West Banas
390	Bhula *	24°34'34"	72°59'14"	West Banas
333	Pindwara	24°48'00"	73°04'00"	West Banas
6	Gadola *	24°10'00"	74°47'60"	Mahi
283	Pratap Garh	24°04'00"	74°46'60"	Chambal
651	Bharai *	24°58'60"	74°04'00"	Banas
80	Railmagra	25°01'60"	74°07'60"	Banas
81	Rajsamand	25°03'27"	73°53'55"	Banas
72	Rashmi	25°03'00"	74°22'00"	Banas
304	Rikhabdeo *	24°07'00"	73°43'00"	Mahi
70	Sahada	25°10'60"	74°13'60"	Banas
299	Jaisamand *	24°14'52"	73°57'18"	Mahi

WRIS code	Station Name	Latitude	Longitude	Basin Name
492	Pilibanga	29°26'60"	74°04'00"	Ghaggar
495	Raisinghnagar	29°31'60"	73°27'00"	Outside Basin
466	Dabla	29°27'55"	73°38'03"	Ghaggar
496	Sadulshahar	29°53'60"	74°10'00"	Outside Basin
467	Dhaban *	29°52'55"	74°30'53"	Outside Basin
497	Sangriya	29°47'52"	74°27'41"	Outside Basin
502	Suratgarh	29°19'00"	73°54'00"	Ghaggar
504	Sunderpura *	29°47'56"	74°05'14"	Outside Basin
508	Tibbi	29°31'60"	74°30'00"	Ghaggar
561	Bali	25°10'60"	73°16'60"	Luni

WRIS code	Station Name	Latitude	Longitude	Basin Name
306	Sarada	24°10'60"	73°54'60"	Mahi
140	Arwar Dam *	25°48'11"	74°48'52"	Banas
151	Ummed Sagar *	25°34'08"	74°54'28"	Banas
147	Nahar Sagar *	25°43'00"	74°57'00"	Banas
150	Shahpura	25°37'25"	74°55'32"	Banas
111	Bhilwara	25°19'40"	74°35'16"	Banas
313	Sallapat	23°10'48"	74°09'51"	Mahi
355	Bilara	26°10'60"	73°42'00"	Luni
353	Jaswant Sagar *	26°13'28"	73°41'21"	Luni

* Maintained by WRD
(a) Maintained by IMD
Note: Other stations without suffix are maintained by Revenue Department

Appendix 3 - Weather Stations

Table A2-1: Summary of Climatological Data and their Availability, Part 1 - Temperature

S. No.	Index No.	Station Name	Maximum Temperature		Highest Maximum Temperature		Minimum Temperature		Lowest Minimum Temperature	
			Data Status	Total number of years (No. of Years with Sufficient Data*)	Data Status	Total number of years (No. of Years with Sufficient Data*)	Data Status	Total number of years (No. of Years with Sufficient Data*)	Data Status	Total number of years (No. of Years with Sufficient Data*)
1	10205	Kota PBO	Closely placed stations#	12 (11)**	Closely placed stations#	12 (11)**	Closely placed stations#	12 (11)**	Closely placed stations#	12 (11)**
2	42123	Ganganagar	Yes	19 (18)	Yes	19 (18)	Yes	19 (18)	Yes	19 (18)
3	42165	Bikaner PBO	Yes	21 (20)	Yes	21 (20)	Yes	21 (20)	Yes	21 (20)
4	42170	Churu	Yes	15 (14)	Yes	15 (14)	Yes	15 (14)	Yes	15 (14)
5	42174	Pilani	Yes	20 (19)	Yes	20 (19)	Yes	20 (19)	Yes	20 (19)
6	42237	Phalodi	Yes	20 (20)	Yes	20 (20)	Yes	20 (20)	Yes	20 (20)
7	42242	Nagaur	Insuf. Data	9 (7)	Insuf. Data	9 (7)	Insuf. Data	9 (7)	Insuf. Data	9 (7)
8	42249	Sikar	Insuf. Data	15 (9)	Insuf. Data	15 (9)	Insuf. Data	15 (9)	Insuf. Data	15 (9)
9	42258	Bharatpur	Insuf. Data	11 (6)	Insuf. Data	11 (6)	Insuf. Data	11 (6)	Insuf. Data	11 (6)
10	42328	Jaisalmer	Yes	16 (15)	Yes	16 (15)	Yes	16 (15)	Yes	16 (15)
11	42339	Jodhpur (a)	Yes	21 (19)	Yes	21 (19)	Yes	21 (19)	Yes	21 (19)
12	42343	Ajmer	Yes	21 (19)	Yes	21 (19)	Yes	21 (19)	Yes	21 (19)
13	42348	Jaipur / Sanganer	Yes	21 (19)	Yes	21 (19)	Yes	21 (19)	Yes	21 (19)
14	42349	Tonk	Insuf. Data	9 (7)	Insuf. Data	9 (7)	Insuf. Data	9 (7)	Insuf. Data	9 (7)
15	42354	Dholpur	Yes	20 (17)	Yes	20 (17)	Yes	20 (17)	Yes	20 (17)
16	42435	Barmer	Yes	21 (19)	Yes	21 (19)	Yes	21 (19)	Yes	21 (19)
17	42439	Jalore	Yes	20 (15)	Yes	20 (15)	Yes	20 (15)	Yes	20 (15)
18	42441	Jawai Bandh	Yes	20 (20)	Yes	20 (20)	Yes	20 (20)	Yes	20 (20)
19	42447	Bhilwara	Insuf. Data	11 (8)	Insuf. Data	11 (8)	Insuf. Data	11 (8)	Insuf. Data	11 (8)
20	42450	Bundi	Insuf. Data	4 (3)	Insuf. Data	4 (3)	Insuf. Data	4 (3)	Insuf. Data	4 (3)

S. No.	Index No.	Station Name	Maximum Temperature		Highest Maximum Temperature		Minimum Temperature		Lowest Minimum Temperature	
			Data Status	Total number of years (No. of Years with Sufficient Data*)	Data Status	Total number of years (No. of Years with Sufficient Data*)	Data Status	Total number of years (No. of Years with Sufficient Data*)	Data Status	Total number of years (No. of Years with Sufficient Data*)
21	42452	Kota (a)	Yes	21 (20)	Yes	21 (20)	Yes	21 (20)	Yes	21 (20)
22	42453	Sawai Madhopur	Yes	19 (19)	Yes	19 (19)	Yes	19 (19)	Yes	19 (19)
23	42540	Abu (Mountabu)	Yes	20 (19)	Yes	20 (19)	Yes	20 (19)	Yes	20 (19)
24	42542	Udaipur (Dabok)	Yes	21 (20)	Yes	21 (20)	Yes	21 (20)	Yes	21 (20)
25	42543	Udaipur	Insuf. Data	7 (6)	Insuf. Data	7 (6)	Insuf. Data	7 (6)	Insuf. Data	7 (6)
26	42546	Chittorgarh	Yes	18 (16)	Yes	18 (16)	Yes	18 (16)	Yes	18 (16)
27	42552	Chambal (Rawat Bhata)	Yes	19 (14)	Yes	19 (14)	Yes	19 (14)	Yes	19 (14)
28	42555	Jhalawar	Yes	20 (16)	Yes	20 (16)	Yes	20 (16)	Yes	20 (16)
29	42655	Banswara	Yes	20 (20)	Yes	20 (20)	Yes	20 (20)	Yes	20 (20)
30	42346	Jobner	NA		NA		NA		NA	

Yes - Considered for analysis
NA - Data not available
Insuf. Data - Insufficient data available
Discarded due to close proximity with another station, to avoid formation of local patches
PBO – Pilot Balloon Observatory of IMD
(a) - Station with suffix (a) represents that the station is situated at Civil Aerodrome.
* - Having minimum 6 month data in a year to qualify for further processing and screening
** - Station not used due to Close proximity with Station Kota (a) inspite of qualifying for data sufficiency

Table A2-1: continued Part 2 – Wind Speed, Evaporation, Humidity and Sunshine

S. No.	Index No.	Station Name	Wind Speed		Evaporation		Relative Humidity		Sunshine Hours	
			Data Status	Total number of years (No. of Years with Sufficient Data*)	Data Status	Total number of years (No. of Years with Sufficient Data*)	Data Status	Total number of years (No. of Years with Sufficient Data*)	Data Status	Total number of years (No. of Years with Sufficient Data*)
1	10205	Kota PBO	Closely placed station#	20 (20)	Insuf. Data, but still considered##	11 (8)	Closely placed station#	19 (18)	NA	
2	42123	Ganganagar	Yes	20 (20)	Yes	19 (18)	Yes	20 (20)	Yes	15 (14)
3	42165	Bikaner PBO	Yes	20 (20)	Yes	17 (15)	Yes	20 (20)	Yes	19 (15)
4	42170	Churu	Yes	20 (20)	Yes	15 (14)	Yes	20 (20)	NA	
5	42174	Pilani	Yes	20 (18)	NA		Yes	20 (18)	NA	
6	42237	Phalodi	Yes	18 (17)	NA		Yes	18 (17)	NA	
7	42242	Nagaur	NA		NA		Insuf. Data	7 (6)	NA	
8	42249	Sikar	Insuf. Data	3 (3)	NA		Insuf. Data	13 (8)	NA	
9	42258	Bharatpur	Outliers	15 (10)	NA		Insuf. Data	15 (9)	NA	
10	42328	Jaisalmer	Yes	18 (18)	Yes	16 (15)	Yes	18 (18)	NA	
11	42339	Jodhpur (a)	Yes	20 (18)	Yes	12 (12)	Yes	20 (19)	Insuf. Data	6 (5)
12	42343	Ajmer	Yes	20 (20)	NA		Yes	20 (20)	NA	
13	42348	Jaipur / Sanganer	Yes	19 (19)	Yes	15 (14)	Yes	19 (19)	Yes	18 (17)
14	42349	Tonk	NA		NA		Insuf. Data	11 (5)	NA	
15	42354	Dholpur	Outliers	20 (15)	NA		Yes	20 (17)	NA	16 (15)
16	42435	Barmer	Yes	19 (19)	Yes	16 (14)	Yes	19 (19)	Yes	
17	42439	Jalore	Yes	16 (11)	NA		Yes	19 (15)	NA	
18	42441	Jawai Bandh	Yes	20 (19)	Yes	11 (10)	Yes	20 (19)	NA	
19	42447	Bhilwara	Insuf. Data	6 (3)	NA		Insuf. Data	13 (10)	NA	
20	42450	Bundi	Outliers	6 (0)	NA		Insuf. Data	7 (3)	NA	
21	42452	Kota (a)	Yes	19 (19)	NA		Yes	19 (19)	NA	
22	42453	Sawai Madhopur	Yes	17 (15)	NA		Yes	20 (19)	NA	

S. No.	Index No.	Station Name	Wind Speed		Evaporation		Relative Humidity		Sunshine Hours	
			Data Status	Total number of years (No. of Years with Sufficient Data*)	Data Status	Total number of years (No. of Years with Sufficient Data*)	Data Status	Total number of years (No. of Years with Sufficient Data*)	Data Status	Total number of years (No. of Years with Sufficient Data*)
23	42540	Abu (Mount Abu)	Outliers	18 (14)	NA		Yes	20 (17)	NA	
24	42542	Udaipur (Dabok)	Yes	19 (19)	Insuf. Data		Yes	19 (19)	NA	
25	42543	Udaipur	Insuf. Data	9 (0)	Yes	16(16)	Insuf. Data	9 (0)	Yes	15 (14)
26	42546	Chittorgarh	Yes	19 (17)	Outliers	10 (10)	Yes	19 (17)	NA	
27	42552	Chambal (Rawat Bhata)	Outliers	19 (11)	Yes	17 (14)	Yes	19 (11)	NA	
28	42555	Jhalawar	Yes	20 (19)	NA		Yes	20 (19)	NA	
29	42655	Banswara	Outliers	20 (19)	Yes	11 (11)	Yes	20 (20)	NA	
30	42346	Jobner	Closely placed stations#	15 (15)	Closely placed stations#	15 (15)	NA		NA	

Yes - Considered for analysis
NA - Data not available
Outliers - Data available but discarded due to abnormal values
Insuf. Data - Insufficient data available
Discarded due to close proximity with another station, to avoid formation of local patches
Station considered for analysis inspite of less data availability
PBO – Pilot Balloon Observatory of IMD
(a) - Station with suffix (a) represents that the station is situated at Civil Aerodrome.
* - Having minimum 6 month data in a year to qualify for further processing and screening

Appendix 4(a)
Basin-wise Salient Features of Existing Major Projects

S.No.	Name of Dam	Year of Construction	River/ Nallah	Nearest City	Latitude (DMS)	Longitude (DMS)	Height above lowest foundation, m	Length of Dam, m	Gross Storage capacity, (Mm3)	Live Storage capacity, (Mm3)	Reser-voir area at FRL, km²	Design Spillway capacity m³/sec	Length of Canal system, km	Command area in Hectares			Free Catchment Area, km²	Districts
														GCA	CCA	ICA		
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
Luni Basin																		
1	Sardar Samand Irrig. Proj.	1995	Sukari	Pali	25 58 46	70 23 06	7.62	9000.00	88.23	88.23	93.35	2556.00	64.70	13245.00	10325.00	8562.00	2064.00	Pali
2	Jawai Dam	1957	Jawai River	Sumerpur	25 05 19	73 08 54	37.20	4215.38	207.52	193.90	24.26	4248.09	23.16	46271.70	38671.00	27070.00	778.00	Pali
Ruparail Basin																		
3	Sikri Bundh	State Time	Rooparail	Sikri	27 32 00	77 04 00	5.17	21790.00	Diversion Dam		NA	32000.00	140.58	10467.00	10467.00	10467.00	982.70	Bharatpur
Banganga Basin																		
4	Ramgarh Bund	1901	Banganga	Jama Ramgarh	27 02 46	76 03 38	26.00	3.08	75.02	73.58	-	2100.00	-	15210.00	12160.00	0.00	769.23	Jaipur
Parbati Basin																		
5	Parbati Irrig. Proj.	1963	Parbati	Bari	26 37 54	77 26 54	28.00	9800.00	120.88	108.29	24.01	1763.00	249.47	32388.00	24667.00	12333.00	786.00	Dhaulpur
Banas Basin																		
6	Morel Bundh	1952	Morel	Lalsot	26 26 50	76 19 55	24.08	5844.20	76.66	70.69	15.70	1602.00	276.00	21306.00	19393.00	11963.00	3345.00	Dausa
7	Kalakh Sagar	1883	-	Phulera	26 58 38	75 27 08	38.00		20.66	20.66	-	NA	52.00	14569.00	10961.00	4537.00	593.11	Jaipur
8	Chhaparwada Bundh	1894	mozamabad		26 36 54	74 14 54	13.00	200.00	53.20	53.20	17.44	800.00	97.60	19218.00	11741.00	4010.00	833.98	Jaipur
9	Bisalpur Irrig. Proj.	1999	Banas	Deoli	25 55 29	75 27 22	39.50	574.00	1095.84	938.60	212.30	27297.00	787.00	113723.00	81800.00	58896.00	8655.00	Tonk
10	Galwa Dam	1960	Banas	Uniyara	25 53 27	76 00 49	7.80	6068.00	48.73	47.26	17.74	3240.00	37.08	NA	13391.00	9239.79	393.68	Tonk
11	Tordisagar Bundh	1888	Banas	Malpura	26 12 45	75 25 01	14.10	1.80	47.12	47.12	55.48	-	80.52	16574.00	13960.00	8372.47	704.88	Tonk
12	Meja Irrig. Proj.	1957	Banas	Bhilwara	25 23 35	74 32 26	19.20	9000.00	84.00	83.55	26.50	-	-	25910.00	20714.00	14500.00	1048.00	Bhilwara
13	Rajsamand Irrig. Proj.	1963	Banas	Rajsamand	25 04 06	73 52 34	-	-	107.00	98.50	18.10	2731.29	-	14225.00	10450.00	7311.00	432.86	Rajsamand
14	Gosunda Irrignation Proj.	-	Banas	Chittorgarh	24 49 35	74 32 23	-	-	101.28	66.98	23.39	-	-	16137.00	4662.00	-		Chittorgarh
Chambal Basin																		
15	Gudha Bundh	1958	Local nalla	Bundi	25 29 22	75 28 02	23.39	2408.00	95.56	93.68	18.58	1686.00	102.28	18141.00	11380.00	11209.00	558.16	Bundi
16	Parwati Pick up weir	State time	Chambal	Baran	24 54 23	76 40 58	2.30	-	diversion	diversion	Nil	15850.00	-	12990.00	12550.00	7530.00	10205.00	Baran
17	Harishchandra Sagar	1956 57	Chambal	Khanpur	24 36 47	76 11 02	0.00	Pickup Weir			-	18406.00	-	22472.00	17978.00	12585.00	12039.00	Jhalawar
18	Kota Barrage	1960	Chambal	Kota	25 10 38	75 49 31	37.34	551.86	112.00	93.67	5.82	24069.00	2567.00	485000.00	229000.00	-	27332.00	Kota
19	Jawahar Sagar Dam	1973	Chambal	Kota	25 02 13	75 40 40	44.80	335.00	67.84	52.00	9.60	21225.00	-	-	-	-	27195.00	Kota
20	Rana Pratap Sagar Dam	1970	Chambal	Chittorgarh	24 55 03	75 35 01	53.95	1143.00	2898.69	1566.53	198.26	18408.00	-	566.60	500.19	396.59	9800.00	Chittorgarh
Mahi Basin																		
21	Jakham Irrig. Proj.	1986	Jakham River	Dhariawad	24 10 11	74 35 28	81.00	253.00	142.02	132.28	11.90	7950.00	74.02	38901.00	28307.92	23495.67	1010.00	Udaipur
22	Mahi Bajaj Sagar	1983	Mahi	Banswara	23 37 40	74 32 45	74.50	3109.00	2180.39	1833.72	139.00	23262.00	2200.00	135000.00	80000.00	71200.00	3149.00	Banswara
23	Som Kamla Amba Irrig. Proj.	1999	Som	Dungarpur	23 58 43	74 01 57	34.50	620.00	172.80	160.30	27.42	20093.00	350.00	25088.00	17724.00	18788.00	1242.50	Dungarpur
24	Jaisamand Irrig. Proj.	1730	Gomti	Udaipur	24 14 30	73 57 10	52.06	335.00	414.60	296.10	52.60	4706.00	330.90	37282.00	16000.00	14400.00	1654.00	Udaipur

FRL = Full Reservoir Level
GCA = Gross Command Area
ICA = Irrigated Command Area
CCA = Culturable Command Area
MCM = Million Cubic Metres

Appendix 4(b)

Basin-wise Salient features of Existing Medium Projects

S. No.	Name of Dam	Year of Const.	River/ Nallah	Nearest City	Latitude, (DMS)	Longitude (DMS)	Ht. Above lowest foundation (m)	Length of Dam (m)	Gross Storage capacity (Mm^3)	Live Storage capacity (Mm3)	Reservoir area at FRL km^2	Design Spillway capacity m^3/sec	Length of Canal system in km	Command area in Hectares			Free Catchment Area, Km^2	Districts
														GCA	CCA	ICA		
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	20
Shekhawati Basin																		
1	Raipur patan Irrig. Proj.	1968	Krishnawati	Raipur	27 45 29	75 58 01	10.00	1524.00	9.17	8.32	3.31	510.30	21.79	2745.00	2207.00	951.00	155.40	Sikar
Ruparel Basin																		
2	Jai samand Irrig. Proj.	1910	Ruparail	Alwar	27 29 31	76 35 12	8.48	1396.00	26.96	24.92	4.69	N.A	27550.00	5590.40	4790.28	3663.60	163.09	Alwar
Banganga Basin																		
3	Ajan Lower Bundh	1875	Banganga	Bhartpur	27 09 57	77 28 30	5.16	15550.00	17.97	17.97	36.40	16280.00	40.73	8097.00	8097.00	8097.00	217.56	Bharatpur
4	Kala kho Bundh	1953	Kharandi	Dausa	26 54 41	76 28 24	15.86	2320.00	13.28	10.82	7.24	430.42	48.00	3778.00	3400.00	1853.00	133.76	Dausa
5	Sainthal Sagar Irrig. Proj.	1998	Sawa River	Dausa	27 01 50	76 15 38	17.00	4180.00	13.73	12.80	5.46	811.00	28.02	4050.00	3267.00	1960.00	255.00	Dausa
6	Madho Sagar Irrig. Proj.	1887	Choi River	Sikarai	26 50 32	76 39 02	14.63	2440.00	22.61	22.50	NA	108.31	34.45	5385.00	3232.00	2382.00	75.40	Dausa
7	Kharad Bundh	1877	Local Nallah	Jama Ramgarh	25 51 55	73 14 41	18.30	N.A	9.19	9.19	NA	156.85		5800.00	4073.00	2404.00	69.12	Jaipur
Gambhir Basin																		
8	Baretha Bundh	1897	Kukund	Bayana	26 53 48	77 22 27	11.28	1150.00	52.64	50.64	13.72	2008.00	65.22	4388.00	4243.00	2970.00	182.00	Bharatpur
9	Juggar Dam	1957	Juggar River	Hindaun	26 43 15	77 05 45	19.15	-	34.97	31.51	9.36	84756.00	-	6264.00	5927.00	4445.00	227.82	Hindon
10	Panchana Dam	2006	Gambhiri	Karauli	26 33 30	77 00 00	85.00	1163.00	59.45	52.65	12.53	202000.00	310.35-	11172.00	9985.00	13410.00	621.60	Kauroli
Parbati Basin																		
11	Ramsagar Dam	State time	Bamani	Bari	26 36 10	77 35 04	10.13	5000.00	30.83	29.39	7.40	395.00	54.71	6231.40	5608.29	3642.30	176.12	Dholpur
12	Urmila Sagar Irrig. Proj.	1905	Babudhen	Dholpur	26 39 13	77 45 31	15.82	3000.00	16.22	15.14	1.87	256.00	29.72	3138.45	2900.00	1535.38	77.70	Dholpur
Sabi Basin																		
13	Buchara Dam	1889	Local Nallah	Kotputali	27 35 22	75 57 55	29.00	570.00	16.36	16.36	4.43	731.00	13.30	3247.00	2638.00	2053.00	220.06	Jaipur
14	Chhitoli Dam	1950	Sabi	Viratnagar	27 28 47	76 07 44	19.50	533.40	24.38	22.23	5.30	26.56	8.60	2539.41	2280.18	2036.95	153.60	Jaipur
Banas Basin																		
15	Narain Sagar Jalia IInd Irrig. Proj.	1967	Khari	Masuda	25 55 52	74 33 15	8076.00	8076.00	19.95	19.82	7.84	2840.00	35.84	4351.00	4087.00	2854.00	23.83	Ajmer
16	Lassadia Bundh	1980-81	Dai Nadi	Kekri	26 02 50	75 10 51	8.00	4325.00	11.49	10.65	2.64	2180.00	2.00	2320.00	2080.00	1352.00	147.00	Ajmer
17	Hingonia Bundh	State time	Local Nallah	Phagi	26 47 00	75 27 45	15.50	1950.00	7.50	7.50	-	NA	16.00	3031.00	2078.00	1238.00	411.81	Jaipur
18	Mora Sagar Irrig. Proj.	1887	Banas	Bamanwas	26 39 48	76 32 20	16.65	880.00	15.57	15.50	5.80	489.00	110.27	2079.00	7374.00	7374.00	193.00	Sawai Madhopur
19	Dheel Bundh	1911	Dheel	Bonli	26 13 24	76 07 03	17.52	5200.00	27.73	27.73	17.70	226.40	93.60	6640.00	5943.32	3350.00	688.90	Sawai Madhopur

S. No.	Name of Dam	Year of Const.	River/ Nallah	Nearest City	Latitude, (DMS)	Longitude (DMS)	Ht. Above lowest foundation (m)	Length of Dam (m)	Gross Storage capacity (Mm^3)	Live Storage capacity (Mm3)	Reservoir area at FRL km^2	Design Spillway capacity m^3/sec	Length of Canal system in km	Command area in Hectares			Free Catchment Area, Km^2	Districts
														GCA	CCA	ICA		
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	20
20	Kalisil Bundh	1956	Kalisil	Sapotara	26 16 05	76 45 56	22.12	2560.00	41.70	37.25	9.37	889.00		4868.00	4700.00	3740.00	331.52	Kauroli
21	Jetpura Bundh	1978	Banas	Bhilwara	25 15 00	75 12 24	21.80	585.00	18.54	16.39	3.78	-	14.19	4050.00	3730.00	2120.00	129.50	Bhilwara
22	Mandal Dam	1905	Local Nallah	Mandalgarh	25 26 53	74 34 01	26.00	1600.00	13.80	11.87	2.14	1300.00	-	-	3818.00	-	99.00	Bhilwara
23	Surawal Bundh	1954	Banas	Sawai Madhopur	26 04 40	76 20 39	40.65	4014.00	25.97	25.55	12.42	475.44	43.00	4910.00	4847.71	4565.00	215.69	Sawai Madhopur
24	Moti sagar Irrig. Proj.	1955	Nalla	Tonk	25 55 42	75 40 27	29.28	1398.00	12.87	12.42	12.37	391.27	28.97	2318.50	2157.00	1780.00	108.78	Tonk
25	Chandsen Bundh	Old	Banas	Malpura	26 20 22	75 27 27	7.80	2070.00	14.70	14.55	25.69	453.00	23.10	3992.00	2597.17	2101.00	155.40	Tonk
26	Mashi Dam	1960	Mashi & Bandi	Niwai	26 24 39	75 45 27	5.10	2103.00	48.14	35.10	15.61	7576.00	94.62	8177.00	6985.00	4890.00	1652.41	Tonk
27	Nand Samand Irrig. Proj.	1957	Banas	Rajsamand	24 55 36	73 46 58	19.20	1002.00	21.22	20.63	4.72	3242.00	42.00	8702.00	7885.00	3255.00	616.60	Rajsamand
28	Mata Ji ka Khera Irrig. Proj.	1959	Banas	Rajsamand	24 56 37	74 03 51	-	-	11.90	11.07	-	-	-	3644.00	3057.00	2140.00	14.16	Rajsamand
29	Badgaon Irrig. Proj.	1966-67	Banas	Mavli	24 42 26	74 05 22	18.75	5202.00	31.52	30.19	9.79	2874.00	28.30	7244.00	6797.00	3440.00	369.94	Chittorgarh
30	Udai Sagar Irrig. Proj.	1964	Bearch	Udaipur	24 34 35	73 49 32	19.35	315.00	31.14	27.59	7.70	1420.36	-	5092.4-	4650.00	1943.00	224.20	Udaipur
31	Vallabhnagar Irrig. Proj.	1966-67	Banas	Udaipur	24 39 20	73 59 20	-	5010.00	30.46	28.78	5.50	826.00	5.39	8401.60	6464.60	3237.60	528.04	Udaipur
32	Bagoliya Dam	1956	Bearch	Udaipur	24 48 48	73 57 11	13.00	-	19.42	18.85	3.50	-	-	3854.80	3676.00	1962.80	168.35	Udaipur
33	Arwar Dam	1957	Mansi	Shahpura	25 48 18	74 48 30	18.28	5250.00	47.91	47.80	18.80	7500.00	64.80	13570.00	7394.00	5467.00	580.00	Bhilwara
34	Khari Dam	1957	Khari	Asind	25 42 21	74 16 52	17.67	2391.00	38.96	33.30	8.84	67530.00	103.15	10121.00	6478.00	3809.00	510.00	Bhilwara
35	Kothari Dam	1989-90	Kothari	Mandalgarh	25 19 00	74 59 45	21.00	4610.00	26.05	21.52	10.43	207474.00	52.90	6120.00	4395.00	3077.00	328.90	Bhilwara
36	Matrikundia Dam		Banas	Bhilwara	25 02 13	74 18 50	-	-	-	49.97	-	-	-		Diversion Dam	-	3415.00	Bhilwara
37	Nahar Sagar	Old tank	Local Nalla	Shahpura	25 43 51	74 57 12	10.67	4685.00	24.63	24.52	15.50	49960.00	27.75	4980.00	4777.00	3506.00	195.00	Bhilwara
38	Sareri Dam	1957	Mansi	Gulabpura	25 41 37	74 34 12	12.80	6336.00	55.77	55.10	18.00	56740.00	83.02	14170.00	9717.00	6303.00	369.00	Bhilwara
39	Ummed Sagar Irrig. Proj.	1917	Local Nalla	Shahpura	25 34 08	74 54 28	10.67	5166.00	17.77	17.77	19.74	43750.00	24.35	5837.00	2968.00	2543.00	174.00	Bhilwara
40	Bassi Dam	1986-87	Local Nallah	Chittorgarh	25 01 57	74 49 23	28.91	520.00	23.20	20.25	4.59	2407.00	15.60	5899.00	3250.00	3169.00	121.70	Chittorgarh
41	Murlia Dam	1967-68	Local Nallah	Nimbahera	24 42 16	74 38 22	10.86	2438.00	9.62	8.47	5.44	475.00	18.45	1497.47	1323.34	957.00	76.77	Chittorgarh
42	Bhopalsagar Irrig. Proj.	old	Banas	Kapasan	24 51 09	74 11 58	28.00	2387.00	18.54	18.42	7.43	645.00	37.15	4401.00	3873.00	2104.00	214.97	Chittorgarh
43	Dindoli Bundh	old	Banas	Rashmi	24 58 52	74 20 36	8.63	1046.00	7.52	7.45	3.40	135.00	7.65	2333.00	2056.00	850.00	20.72	Chittorgarh
44	Gambhiri Bundh	1957-58	Gambhiri	Nimbahera	24 42 11	74 43 48	19.84	3200.00	54.98	53.44	26.00	2510.00	75.82	8385.00	7575.00	5466.00	1036.00	Chittorgarh
45	Orai Dam	1972-73	Banas	Begun	25 02 11	74 50 48	24.38	1365.00	35.28	32.82	6.23	1574.00	31.34	12708.00	9260.00	4630.00	220.32	Chittorgarh

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														GCA	CCA	ICA		
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	20
46	Wagan Irrig. Proj.	1982-83	Wagan	Dungla	24 29 34	74 24 38	14.00	3000.00	40.65	37.58	16.00	2427.00	45.75	9790.00	8270.00	5541.00	256.00	Chittorgarh
47	Chandra Bhaga Irrig. Proj.	1957-58	Chandra Bhaga	Shada	25 10 22	74 04 13	10.52	N.A	9,97	9.85	N.A.	1217.78	11.82	6880.00	3342.00	1128.00	132.09	Bhilwara
	Chambal Basin																	
48	Parwan Pick up weir	-	-	Baran	24 42 46	76 33 19	-	884.00	diversion	diversion	Nil	13859.50	-	7550.00	7464.00	-	8294.00	Baran
49	Parwan Lift Scheme	2001	-	Baran	24 58 12	76 25 03	4.16	864.00	22.50	19.90	Nil	15608.00	-	10620.00	9531.00	9135.00	9175.00	Baran
50	Gopal pura Dam	1980	Kui	Baran	25 09 53	76 43 52	14.43	4389.00	32.64	32.01	6.29	1229.00	-	5718.00	3557.00	3410.00	229.22	Baran
51	Ummed sagar Irrig. Proj.	State time	Khari	Baran	25 12 00	76 45 30	13.20	4511.00	18.60	18.60	5.52	2101.00	-	5837.00	2968.00	2613.00	480.60	Baran
52	Bilas Irrig. Proj.	-	-	Baran	25 03 18	76 49 40	19.70	3750.00	28.88	26.76	6.50	1812.00	-	6390.00	5863.00	5863.00	233.00	Baran
53	Bethali Irrig. Proj.	-	-	Baran	24 37 14	76 58 21	22.66	2900.00	31.61	29.00	6.90	1312.00	-	5526.00	5026.00	5026.00	143.40	Baran
54	Bhimsagar Irrig. Proj.	1996-97	Ujjar	Khanpur	24 33 45	76 20 03	32.00	161.58	76.60	72.53	18.02	2717.00	45.62	11011.00	9986.00	8988.00	328.30	Jhalawar
55	Chhapi Irrig. Proj.	2005-06	Chhapi	Aklera	24 20 35	76 28 21	34.80	312.00	82.57	73.57	10.85	4370.00	34.24	9642.00	9375.00	14820.00	309.14	Baran
56	Chauli Irrig. Proj.	2006-07	Chauli	Pirawa	24 14 39	76 05 39	21.75	2625.00	53.50	48.22	11.37	1210.00	27.34	8472.00	7794.00	8963.00	211.40	Jhalawar
57	Alnia Dam	1962	Alnia	Kota	25 00 10	75 52 44	14.94	914.40	43.72	43.71	12.10	2605.00	84.50	8986.00	7882.00	5636.00	201.43	Kota
58	Bhimlat Abhaypura Irrig. Proj.	1952	Bhimlat	Bundi	25 17 53	75 24 07	55.25	1599.00	19.10	18.87	4.49	1319.30	38.00	3632.00	3402.00	2586.00	103.74	Bundi
59	Sawan Bhadon Irrig. Proj.	2001	Aru	Kota	24 49 17	76 05 47	28.00	4240.00	30.03	27.85	4.40	1544.00	14.70	6517.00	5850.00	5779.00	146.07	Kota
60	Burdha Dam	State Time	Local Nallah	Bundi	25 14 37	75 41 42	9.58	594.91	28.98	28.97	4.54	1245.20	48.00	5016.60	4272.87	4272.81	334.14	Bundi
61	Bundi Ka Gothra Irrig. Proj.	1957	Local Nallah	Bundi	25 41 28	75 38 51	9.30	1712.30	18.97	18.97	9.73	797.40	22.70	8112.00	5560.00	2783.00	238.28	Bundi
62	Dugari Dam	State Time Tank	Local Nallah	Bundi	25 41 51	75 53 02	7.40	225.60	18.08	18.08	3.12	448.20	7.85	2877.00	2251.00	1560.00	112.66	Bundi
63	Man Sarovar Dam	1952	Kundeli	Khandar	25 55 30	76 26 30	50.00	930.00	17.48	16.21	8.00	921.42	28.80	4041.00	3166.80	3167.00	103.25	Sawai Madhopur
64	Takli Irrig. Proj.	2012	Takli	Kota	24 42 08	75 52 51	16.00	5400.00	33.74	29.90	13.84	2294.00	35.00	8033.00	7386.00	6648.00	-	Kota
65	Lhasi Irrig. Proj.	2012	Lhasi	Baran	24 35 10	76 42 21	17.58	22.23	30.88	28.30	8.45	1619.52	19.50	4321.00	4026.00	4385.00	128.70	Baran
66	Piplad Irrig. Proj.	2009	Piplad	Pachar	24 24 22	75 53 23	15.77	3978.50	24.14	21.50	8.03	1463.00	17.70	5806.00	4688.00	6345.00	114.00	Jhalawar
67	Gagrain Irrig. Proj.	2010	-	Pirawa	24 07 40	75 54 51	2535.00	2535.00	52.60	47.10	-	4447.00	-	10662.00	7943.00	9675.00	569.40	Jhalawar

S. No.	Name of Dam	Year of Const.	River/ Nallah	Nearest City	Latitude, (DMS)	Longitude (DMS)	Ht. Above lowest foundation (m)	Length of Dam (m)	Gross Storage capacity (Mm^3)	Live Storage capacity (Mm3)	Reservoir area at FRL km^2	Design Spillway capacity m^3/sec	Length of Canal system in km	Command area in Hectares			Free Catchment Area, Km^2	Districts
														GCA	CCA	ICA		
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	20
68	Galwaniya Dam	1954	Banas	Uniyara	25 51 46	76 11 36	6.70	3.28	12.51	11.39	28.76	396.00	17.92	2435.00	2257.00	2257.49	71.60	Tonk
Luni Basin																		
69	Phool Sagar Jalia Irrig. Proj.	1911	Local	Beawar	26 04 06	74 16 27	NA	1710.00	9.77	9.48	NA	11464.00	7.55	2936.50	2350.50	1354.00	10.60	Ajmer
70	Hemawas Irrig. Proj.	State time	Sumer	Pali	25 43 27	73 20 14	12.00	7924.88	62.53	62.53	22.85	2604.06	33.59	9115.00	8704.00	6093.00	907.00	Pali
71	Kharda Bund	State time	Kharda feeder & local catchment	Pali	25 51 55	73 14 41	7.00	3000.00	18.80	18.80	9.87	121.69	17.82	3006.00	2451.00	2220.00	180.00	Pali
72	Giroliya Dam	1976 77	Bandi Nallah	Pali	25 46 10	73 02 46	3.65	3960.00	4.95	4.20	34.55	938.15	15.69	2540.00	2429.00	1215.00	691.00	Pali
73	Raipur luni Dam	1964 68	Raipur Luni River	Raipur	26 01 14	74 03 46	18.90	341.50	12.54	10.95	NA	944.37	22.81	4168.24	2605.15	1563.09	325.11	Pali
74	Ora Dam	1957 58	Khari River	Sheoganj	25 01 41	72 48 36	22.12	5617.46	22.66	22.29	4.86	836.87	1100 CH	5283.40	4616.19	3186.23	92.00	Pali
75	Bankli Bund	1904	Sukari	Bhadrajun	25 42 16	72 52 59	11.74	1148.48	34.51	34.51	13.75	3863.40	38.82	5772.00	5380.00	3767.00	1777.00	Jalore
76	Bandi Sendra Bund	2007	Bandi	Bhinmal	24 57 40	72 26 00	19.00	2704.00	28.68	25.98	6.20	2942.00	44.66	6681.52	6288.81	4615.15	382.00	Jalore
77	Angore Dam	1988	Krishnawati River	Angore	24 52 53	72 46 09	19.81	2362.79	14.02	13.22	4.05	611.71	40.63	3350.79	3455.28	2630.51	155.39	Sirohi
78	Bisalpura Dam	1991-92	Jozhri	Jodhpur	26 14 00	73 19 00	4.57	8900.16	6.60	5.82	9.77	1834.04	7.16	3075.00	2830.00	2015.50	499.80	Jhodpur
79	Jaswant Sagar	1899	Luni	Jhodpur	26 13 40	73 41 21	13.35	12150.00	52.78	52.58	18.12	7247.73	37.86	7244.13	6379.00	5463.16	3367.00	Jhodpur
Sukli Basin																		
80	Sukli Selwara Irrig. Proj.	2008	Sukli River	Selwara	24 38 58	72 36 15	8.50	4514.00	29.51	25.58	8.37	2908.95	44.67	6820.35	5000.00	5000.00	277.10	Jodhpur
West Banas																		
81	West Banas Irrig. Proj.	1965-66	W. Banas River	Dhanari	24 41 33	72 55 50	16.74	4670.00	39.07	36.25	9.41	1481.56	74.12	9848.00	7952.00	5566.00	414.00	Jodhpur
Mahi Basin																		
82	Surwania Irrig. Proj.	1963-64	Gujariya	Banswara	23 29 26	74 22 06	15.28	3083.00	13.19	11.33	N.A.	31050.00	25.00	2659.00	2228.00	1340.00	106.10	Banswara
83	Somkagdar Irrig. Proj.	1996	Som	Reshabdev	24 01 45	73 37 45	27.02	480.00	36.19	34.44	4.50	3259.00	180.80	9887.00	5739.00	4935.00	564.00	Udaipur

FRL = Full Reservoir Level
GCA = Gross Command Area
ICA = Irrigated Command Area
CCA = Culturable Command Area

Appendix 4(c) - Basin-wise Salient Features of Existing Minor Irrigation projects

S. No.	Project Name	District	Block	Basin	Sub-basin	Class	Latitude (DD)	Longitude (DD)	Ht. above Lowest Foundation (m)	Length of Dam (m)	Gross Storage Capacity (Mm^3)	Live Storage Capacity (Mm^3)	Reservoir Area at FRL (km^2)	Design Spilway Capacity (cusecs)	Length of Canal System (km)	Command Area (ha)		
																GCA	CCA	ICA
1	2	3	4	5	6	7	9	10	11	12	13	14	15	16	17	18	19	20
105	Chorolav Tank Sawar	AJMER	Kekri	Banas	Banas	MINOR	25.761170	75.208764	3.50	2,100.00	0.28	0.28	NA	51.62	1.89	39.67	39.70	39.67
387	Footia Talab Ghatiyali	AJMER	Kekri	Banas	Banas	Minor	25.775714	75.272391	NA	NA	0.35	0.34	NA		NA	50.18	50.18	50.18
242	Mathalav Kekri	AJMER	Kekri	Banas	Banas	MINOR	25.718336	75.177744	3.50	2,580.00	0.42	0.42	NA	45.67	NA	48.58	48.60	48.58
1041	Agriya Pandir	BHILWARA	Jahazpur	Banas	Banas	MINOR	25.650151	75.164694				0.40					41.00	
1043	Ajrea Pander	BHILWARA	Jahazpur	Banas	Banas	MINOR	25.636106	75.145211				0.42					41.00	
1064	Atolia	BHILWARA	Jahazpur	Banas	Banas	MINOR	25.718231	75.166916				0.97					185.00	
1070	Bada Talab Chilawas	BHILWARA	Jahazpur	Banas	Banas	MINOR	25.688592	75.213522	3.50	2,003.00	0.23	0.21	NA	19.13	NA	28.34	28.30	28.34
1083	Bander Ka Naka	BHILWARA	Jahazpur	Banas	Banas	MINOR	25.502396	75.208623				0.74					288.00	
1087	Baradpura	BHILWARA	Jahazpur	Banas	Banas	MINOR	25.701037	75.350156				1.90					362.00	
1088	Barla Poliya	BHILWARA	Jahazpur	Banas	Banas	MINOR	25.721420	75.330907				1.53					75.00	
1101	Bharani Kalan	BHILWARA	Jahazpur	Banas	Banas	MINOR	25.550512	75.161907				0.22					38.00	
1104	Bhawani pura	BHILWARA	Jahazpur	Banas	Banas	MINOR	25.540166	75.288187				0.34					65.00	
1125	Borani	BHILWARA	Jahazpur	Banas	Banas	MINOR	25.521618	75.277954				0.20					40.40	
1172	Dhandola	BHILWARA	Jahazpur	Banas	Banas	MINOR	25.647508	75.299350				0.96					182.00	
1186	Falasia	BHILWARA	Jahazpur	Banas	Banas	MINOR	25.618105	75.126537				0.25					49.00	
1188	Fateh Sagar (Srangara	BHILWARA	Jahazpur	Banas	Banas	MINOR	25.538384	75.261030				1.11					213.00	
1470	Gandher	BHILWARA	Jahazpur	Banas	Banas	Minor	25.699144	75.183899				0.43					111.33	
1197	Ganeshpura(d)	BHILWARA	Jahazpur	Banas	Banas	MINOR	25.670037	75.271350				1.25					211.00	
1471	Gatola	BHILWARA	Jahazpur	Banas	Banas	Minor	25.626322	75.282367				0.23					40.49	
1242	Jawan Sagar	BHILWARA	Jahazpur	Banas	Banas	MINOR	25.616695	75.250666				0.25					49.00	
1248	Jhalra Tank	BHILWARA	Jahazpur	Banas	Banas	MINOR	25.619418	75.087674				0.76					205.00	
1258	Kakta	BHILWARA	Jahazpur	Banas	Banas	MINOR	25.476879	75.134273				0.34					65.00	
1275	Khatola	BHILWARA	Jahazpur	Banas	Banas	MINOR	25.637614	75.293100				0.55					97.00	
1312	Malola	BHILWARA	Jahazpur	Banas	Banas	MINOR	25.587519	75.226088				0.65					101.00	
1315	Mayla Polia	BHILWARA	Jahazpur	Banas	Banas	MINOR	25.717150	75.352025				0.42					81.00	
1317	Meghpura	BHILWARA	Jahazpur	Banas	Banas	MINOR	25.465495	75.168466				0.35					99.00	
1323	Mool Sagr Titori	BHILWARA	Jahazpur	Banas	Banas	MINOR	25.658788	75.119334				0.17					32.00	
1326	Nagdi	BHILWARA	Jahazpur	Banas	Banas	MINOR	25.569506	75.279560	13.70	1,165.00	5.15	5.09	-	11,500.00	8.25	1,943.00	1,692.00	583.00
1327	Nahar Sagar (Ulela)	BHILWARA	Jahazpur	Banas	Banas	MINOR	25.506049	75.234475				0.69					112.00	
1358	PanchanPura	BHILWARA	Jahazpur	Banas	Banas	MINOR	25.533797	75.175185				0.38					78.00	
1465	Ratanpura	BHILWARA	Jahazpur	Banas	Banas	Minor	25.444920	75.143446				0.23					43.72	
1410	Sarsiya Charan	BHILWARA	Jahazpur	Banas	Banas	MINOR	25.579443	75.156147				0.76					146.00	
1418	Shiv Sagar Paroli	BHILWARA	Jahazpur	Banas	Banas	MINOR	25.513625	75.118331	8.65	2,882.00	3.27	2.94	-	463.00	11.59	765.00	561.00	421.00
1437	Taswariya	BHILWARA	Jahazpur	Banas	Banas	MINOR	25.624493	75.069137				0.23					43.00	
1441	Tikar	BHILWARA	Jahazpur	Banas	Banas	MINOR	25.706046	75.390063				0.16					18.00	
1453	Uncha	BHILWARA	Jahazpur	Banas	Banas	MINOR	25.734308	75.354104				0.25					48.00	
1085	Banka Khera	BHILWARA	Kotri	Banas	Banas	MINOR	25.312495	74.808885				0.42					69.00	
1123	Birdol	BHILWARA	Kotri	Banas	Banas	MINOR	25.446887	74.943882				0.25					49.00	
1162	Deoria	BHILWARA	Kotri	Banas	Banas	MINOR	25.380960	74.950306				1.84					423.00	
1176	Dhokliya (Sawant sagar)	BHILWARA	Kotri	Banas	Banas	MINOR	25.386273	74.879356				0.17					35.00	
1187	Fateh Sagar (Kotri)	BHILWARA	Kotri	Banas	Banas	MINOR	25.422719	74.932081				1.55					217.00	
1223	Hathipura	BHILWARA	Kotri	Banas	Banas	MINOR	25.288952	74.909924				0.67					162.00	
1235	Jagpura	BHILWARA	Kotri	Banas	Banas	MINOR	25.391264	74.980903				0.11					30.00	
1245	Jhado	BHILWARA	Kotri	Banas	Banas	MINOR	25.411234	74.944048	14.45	1,507.00	10.34	9.29	4,430.00	21,160.00	29.49	2,067.00	1,786.00	1,195.00
1247	Jhadol S0mll	BHILWARA	Kotri	Banas	Banas	MINOR	25.446023	74.880501				0.77					146.00	
1265	Karamdas	BHILWARA	Kotri	Banas	Banas	MINOR	25.413192	74.850952				0.17					32.00	
1281	Kheri Khurd	BHILWARA	Kotri	Banas	Banas	MINOR	25.499720	74.939451				0.49					79.00	
1330	Narayan Sagar Reeth	BHILWARA	Kotri	Banas	Banas	MINOR	25.414764	74.832469				0.33					53.00	
1334	Naval Sagar	BHILWARA	Kotri	Banas	Banas	MINOR	25.520123	74.980726				0.36					69.00	
1475	Ratansagar Berunda	BHILWARA	Kotri	Banas	Banas	Minor	25.473781	75.075139				1.20					250.00	
1396	Samdri Talab	BHILWARA	Kotri	Banas	Banas	MINOR	25.479577	75.016116				0.53					81.00	
1476	Sankra Anicut	BHILWARA	Kotri	Banas	Banas	Minor	25.452080	74.973128				-					-	
1402	Sankra Bada	BHILWARA	Kotri	Banas	Banas	MINOR	25.463208	74.983852				0.31					60.00	
1408	Sarla Sagar	BHILWARA	Kotri	Banas	Banas	MINOR	25.481258	74.938348				0.62					191.00	
1409	Sarsadi	BHILWARA	Kotri	Banas	Banas	MINOR	25.439614	74.847652				0.18					35.00	
1415	Sher Sagar Girdia	BHILWARA	Kotri	Banas	Banas	MINOR	25.494623	74.926589				0.18					59.00	
1425	Stola Ka Khera	BHILWARA	Kotri	Banas	Banas	MINOR	25.382815	74.858885				0.37					71.00	
1456	Undisankra (Sankrathara)	BHILWARA	Kotri	Banas	Banas	MINOR	25.489320	74.959750				1.90					259.00	
1459	Vinod Sagar	BHILWARA	Kotri	Banas	Banas	MINOR	25.282561	74.889012				0.50					28.00	
1055	Anwasa	BHILWARA	Mandalgarh	Banas	Banas	MINOR	25.245580	75.123334				2.72					584.00	
1119	Bikaran	BHILWARA	Mandalgarh	Banas	Banas	MINOR	25.173275	75.254557				0.41					68.00	
1179	Dholpura (Nahargarh)	BHILWARA	Mandalgarh	Banas	Banas	MINOR	25.250850	75.187433				0.27					61.00	
1290	Kundia Khal	BHILWARA	Mandalgarh	Banas	Banas	MINOR	25.415071	75.110739				1.94					371.00	
1305	Lodi ji Ka Khera	BHILWARA	Mandalgarh	Banas	Banas	MINOR	25.321148	75.160084				0.49					106.00	
1401	Sangrampura	BHILWARA	Mandalgarh	Banas	Banas	MINOR	25.296159	75.166466				0.39					68.00	

S. No.	Project Name	District	Block	Basin	Sub-basin	Class	Latitude (DD)	Longitude (DD)	Ht. above Lowest Foundation (m)	Length of Dam (m)	Gross Storage Capacity (Mm^3)	Live Storage Capacity (Mm^3)	Reservoir Area at FRL (km^2)	Design Spilway Capacity (cusecs)	Length of Canal System (km)	Command Area (ha)		
																GCA	CCA	ICA
1	2	3	4	5	6	7	9	10	11	12	13	14	15	16	17	18	19	20
1432	Swaroop Ji Ka Khera	BHILWARA	Mandalgarh	Banas	Banas	MINOR	25.278337	75.189209				0.93					201.00	
1439	Thal	BHILWARA	Mandalgarh	Banas	Banas	MINOR	25.350091	75.109636				0.58					110.00	
1061	Armia Jagir	BHILWARA	Sahara	Banas	Banas	MINOR	25.175592	74.186073				0.36					69.00	
1076	Bagera	BHILWARA	Sahara	Banas	Banas	MINOR	25.154914	74.268578				0.37					52.00	
1100	Bharak	BHILWARA	Sahara	Banas	Banas	MINOR	25.132389	74.267319				0.50					95.00	
1113	Bholi Khera	BHILWARA	Sahara	Banas	Banas	MINOR	25.220757	74.189906				0.74					140.00	
1114	Bhopal Sagar Girdia	BHILWARA	Sahara	Banas	Banas	MINOR	25.200000	74.116667				1.67					293.00	
1116	Bhunawas	BHILWARA	Sahara	Banas	Banas	MINOR	25.240138	74.368582				0.96					184.00	
1120	Bikrai	BHILWARA	Sahara	Banas	Banas	MINOR	25.130894	74.305332				0.79					154.00	
1124	Bodha Khera	BHILWARA	Sahara	Banas	Banas	MINOR	25.167191	74.369707				0.64					127.00	
1143	Chor Baori	BHILWARA	Sahara	Banas	Banas	MINOR	25.063061	74.189910				0.59					136.00	
1159	Delana Nicahla	BHILWARA	Sahara	Banas	Banas	MINOR	25.235545	74.234887				0.40					55.00	
1160	Delana Pangdhia	BHILWARA	Sahara	Banas	Banas	MINOR	25.222673	74.229238				0.39					58.00	
1181	Dhosar	BHILWARA	Sahara	Banas	Banas	MINOR	25.234663	74.348482				0.71					135.00	
1189	Fateh Sagar Salera	BHILWARA	Sahara	Banas	Banas	MINOR	25.204810	74.133777	5.49	1,554.00	1.39	1.39	-	4,635.00	4.50	-	321.00	159.00
1193	Galwa	BHILWARA	Sahara	Banas	Banas	MINOR	25.172546	74.145482				0.62					84.00	
1211	Guda	BHILWARA	Sahara	Banas	Banas	MINOR	25.162221	74.258832				0.53					102.00	
1226	Himatsagar Shivrati	BHILWARA	Sahara	Banas	Banas	MINOR	25.250961	74.302254				1.02					194.00	
1253	Juna Talab Shivrati	BHILWARA	Sahara	Banas	Banas	MINOR	25.234670	74.319003				0.29					57.00	
1474	Kali Megari Ka Khera	BHILWARA	Sahara	Banas	Banas	Minor	25.239007	74.242294				0.29					62.00	
1274	Khati Khera	BHILWARA	Sahara	Banas	Banas	MINOR	25.220862	74.246882				0.28					53.00	
1292	Kushal Sagar Kagni	BHILWARA	Sahara	Banas	Banas	MINOR	25.197088	74.147932				0.51					74.00	
1293	Lakhamaniyas	BHILWARA	Sahara	Banas	Banas	MINOR	25.188793	74.337155				0.50					76.00	
1294	Lakhola	BHILWARA	Sahara	Banas	Banas	MINOR	25.162625	74.287179	4.90	2,731.00	2.69	2.70	-	7,135.00	9.30	-	513.00	308.00
1309	Mahendragarh	BHILWARA	Sahara	Banas	Banas	MINOR	25.265305	74.364448				0.71					137.00	
1313	Man Sagar Kagni	BHILWARA	Sahara	Banas	Banas	MINOR	25.198635	74.177860				1.02					113.00	
1338	Naya Talab (d)	BHILWARA	Sahara	Banas	Banas	MINOR	25.226700	74.325483				1.08					147.00	
1373	Potlan	BHILWARA	Sahara	Banas	Banas	MINOR	25.126781	74.220762	5.79	1,521.00	1.36	1.33	-	6,106.00	6.15	-	301.00	152.00
1380	Raithlias	BHILWARA	Sahara	Banas	Banas	MINOR	25.073029	74.197284	8.84	3,419.00	8.21	7.27	-	41,900.00	12.30	1,624.00	1,550.00	930.00
1393	Sahada	BHILWARA	Sahara	Banas	Banas	MINOR	25.172906	74.252369				1.10					162.00	
1405	Sargaon	BHILWARA	Sahara	Banas	Banas	MINOR	25.091810	74.258190				0.85					162.00	
1421	Sirohi Khera	BHILWARA	Sahara	Banas	Banas	MINOR	25.184946	74.161576				0.28					54.00	
1423	Soniyana	BHILWARA	Sahara	Banas	Banas	MINOR	25.166680	74.356812				0.45					90.00	
1435	Taperia Kheri	BHILWARA	Sahara	Banas	Banas	MINOR	25.132314	74.152059				0.28					54.00	
1445	Tiloli	BHILWARA	Sahara	Banas	Banas	MINOR	25.101343	74.273306				0.12					15.00	
1110	Bhojpura	BHILWARA	Shahpura	Banas	Banas	MINOR	25.464128	74.862944				0.28					138.00	
1306	Lulas	BHILWARA	Shahpura	Banas	Banas	MINOR	25.487585	74.846253				1.47					263.00	
1395	Saleria Khurd	BHILWARA	Shahpura	Banas	Banas	MINOR	25.476350	74.907647				0.17					73.00	
1065	Atun	BHILWARA	Suwana	Banas	Banas	MINOR	25.283945	74.625543				0.28					54.00	
1073	Bada Talab Pur	BHILWARA	Suwana	Banas	Banas	MINOR	25.301060	74.540327				1.35					257.00	
1091	Basodia	BHILWARA	Suwana	Banas	Banas	MINOR	25.163181	74.569665				0.03					27.00	
1112	Bholi	BHILWARA	Suwana	Banas	Banas	MINOR	25.279356	74.678297				0.77					148.00	
1126	Borda	BHILWARA	Suwana	Banas	Banas	MINOR	25.288234	74.608577				0.24					45.00	
1153	Danthal	BHILWARA	Suwana	Banas	Banas	MINOR	25.294023	74.757710				0.29					47.00	
1195	Ganeshpura (C)	BHILWARA	Suwana	Banas	Banas	MINOR	25.277635	74.444988				0.56					109.00	
1218	Guwardi	BHILWARA	Suwana	Banas	Banas	MINOR	25.258650	74.626200				5.83					1,103.00	
1222	Hathibhata	BHILWARA	Suwana	Banas	Banas	MINOR	25.281431	74.770482				1.10					165.00	
1233	Jagadhari	BHILWARA	Suwana	Banas	Banas	MINOR	25.220125	74.490078				0.27					52.00	
1262	Kaniya Kheri	BHILWARA	Suwana	Banas	Banas	MINOR	25.177953	74.554580				3.81					617.00	
1264	Kanpura	BHILWARA	Suwana	Banas	Banas	MINOR	25.204769	74.471842				0.23					43.00	
1268	Karoi	BHILWARA	Suwana	Banas	Banas	MINOR	25.230201	74.413205				0.80					174.00	
1289	Kumaria Khera	BHILWARA	Suwana	Banas	Banas	MINOR	25.288381	74.574481				0.22					38.00	
1308	Madhopur	BHILWARA	Suwana	Banas	Banas	MINOR	25.270450	74.601046				0.37					70.00	
1348	Neogaon	BHILWARA	Suwana	Banas	Banas	MINOR	25.245697	74.531654				1.72					488.00	
1352	Ojagar	BHILWARA	Suwana	Banas	Banas	MINOR	25.258786	74.433405				0.30					45.00	
1353	Ojara	BHILWARA	Suwana	Banas	Banas	MINOR	25.169789	74.606176				0.89					183.00	
1484	Parvati Sagar	BHILWARA	Suwana	Banas	Banas	Minor	25.251334	74.452944	9.45	562.00	0.52	0.46	0.80	2,435.00	2.19	73.68	72.87	65.58
1374	Pur Ikhatola	BHILWARA	Suwana	Banas	Banas	MINOR	25.262921	74.525610				0.14					21.00	
1375	Pur Kanoda	BHILWARA	Suwana	Banas	Banas	MINOR	25.298962	74.519606				1.03					165.00	
1383	Ranjeetsgar Curla	BHILWARA	Suwana	Banas	Banas	MINOR	25.255350	74.473943				2.36					450.00	
1391	Sabalpura	BHILWARA	Suwana	Banas	Banas	MINOR	25.300346	74.679636				0.40					77.00	
1403	Santburin	BHILWARA	Suwana	Banas	Banas	MINOR	25.151735	74.595729				0.31					52.00	
1477	Sathuria	BHILWARA	Suwana	Banas	Banas	Minor	25.189376	74.433499				0.27					52.00	
1426	Sunderpura	BHILWARA	Suwana	Banas	Banas	MINOR	25.280368	74.611301				0.19					36.00	
1443	Tiloli	BHILWARA	Suwana	Banas	Banas	MINOR	25.281258	74.392499				0.12					16.00	
1597	Ganeshpura (a)	CHITTAURGARH	Gangrar	Banas	Banas	MINOR	25.124463	74.533519	4.88	1,666.00	0.85	0.83	21.00	99.00	4.00	226.72	194.00	97.00
1567	Arni	CHITTAURGARH	Rashmi	Banas	Banas	MINOR	25.067700	74.304440	9.22	1,661.00	1.56	1.56	0.16	225.00	4.00	509.00	499.00	178.00

S. No.	Project Name	District	Block	Basin	Sub-basin	Class	Latitude (DD)	Longitude (DD)	Ht. above Lowest Foundation (m)	Length of Dam (m)	Gross Storage Capacity (Mm^3)	Live Storage Capacity (Mm^3)	Reservoir Area at FRL (km^2)	Design Spilway Capacity (cusecs)	Length of Canal System (km)	Command Area (ha)		
																GCA	CCA	ICA
1	2	3	4	5	6	7	9	10	11	12	13	14	15	16	17	18	19	20
1602	Jadana	CHITTAURGARH	Rashmi	Banas	Banas	MINOR	25.044084	74.406737	3.81	605.00	0.48	0.48	42.00	36.00	1.00	331.58	259.00	55.00
1613	Karjia	CHITTAURGARH	Rashmi	Banas	Banas	MINOR	25.135005	74.407273	5.11	2,122.00	1.22	1.19	104.00	62.00	5.00	138.06	102.00	100.00
1620	Lasadia (d)	CHITTAURGARH	Rashmi	Banas	Banas	MINOR	25.170475	74.403035	4.11	1,961.00	0.26	0.23	20.00	40.00	1.00	63.97	33.00	26.00
1630	Murni	CHITTAURGARH	Rashmi	Banas	Banas	MINOR	25.089449	74.444122				0.74					133.00	
1631	Muroli	CHITTAURGARH	Rashmi	Banas	Banas	MINOR	25.088011	74.403213	6.10	1,861.00	0.27	0.25	53.00	48.00	4.00	70.85	57.00	28.00
1659	Sethuria	CHITTAURGARH	Rashmi	Banas	Banas	MINOR	25.182348	74.424531				0.27					51.00	
1662	Somi	CHITTAURGARH	Rashmi	Banas	Banas	MINOR	25.089756	74.353286	8.75	3,279.00	2.24	1.88	0.15	976.00	9.00	736.00	582.00	269.00
1667	Unchakia	CHITTAURGARH	Rashmi	Banas	Banas	MINOR	25.191236	74.393996	12.85	3,277.00	5.27	5.04	0.25	90.00	12.00	839.00	813.00	576.00
2734	Agria	RAJSAMAND	Amet	Banas	Banas	MINOR	25.257882	73.921856				0.58					71.00	
2744	Bhadla	RAJSAMAND	Amet	Banas	Banas	MINOR	25.271095	73.991040				0.59					73.00	
2768	Govila pick up weir	RAJSAMAND	Amet	Banas	Banas	MINOR	25.206148	74.064544				0.47					67.21	
2769	Gugli ki Phoot	RAJSAMAND	Amet	Banas	Banas	MINOR	25.226053	73.903141				0.46					101.00	
2795	Liki new	RAJSAMAND	Amet	Banas	Banas	MINOR	25.318274	73.964871				0.40					110.00	
2796	Liki Old	RAJSAMAND	Amet	Banas	Banas	MINOR	25.316104	73.957139				0.73					104.39	
2797	Manohar Sagar	RAJSAMAND	Amet	Banas	Banas	MINOR	25.241500	73.978984				5.82					1,495.00	
2809	Panotia	RAJSAMAND	Amet	Banas	Banas	MINOR	25.201783	73.951075				0.48					67.00	
2817	Salam Sagar	RAJSAMAND	Amet	Banas	Banas	MINOR	25.283730	73.925117				0.38					69.00	
2737	Bada Bhanuja	RAJSAMAND	Khamnor	Banas	Banas	MINOR	24.920686	73.634681				0.50					101.00	
2746	Bhensa Kamed	RAJSAMAND	Khamnor	Banas	Banas	MINOR	25.003199	73.684600				1.15					283.00	
2754	Chikalwas	RAJSAMAND	Khamnor	Banas	Banas	MINOR	25.027416	73.724574				10.96					1,965.00	
2764	Gaon Guda	RAJSAMAND	Khamnor	Banas	Banas	MINOR	25.011936	73.643356				0.56					69.00	
2777	Kadmal	RAJSAMAND	Khamnor	Banas	Banas	MINOR	24.879167	73.666667				0.45					104.00	
2788	Kunthwa pick up weir	RAJSAMAND	Khamnor	Banas	Banas	MINOR	24.987772	73.761980				0.16					102.00	
2816	Sagroon	RAJSAMAND	Khamnor	Banas	Banas	MINOR	24.885044	73.660783				0.85					173.00	
2818	Saloda	RAJSAMAND	Khamnor	Banas	Banas	MINOR	24.909593	73.672343				1.69					255.00	
2833	Bamniya pick up weir	RAJSAMAND	Kumbhalgarh	Banas	Banas	Minor	25.284798	73.736520				0.09					1,013.00	
2741	Banokda	RAJSAMAND	Kumbhalgarh	Banas	Banas	MINOR	24.927078	73.551546				0.39					60.00	
2761	Dhanin Sakrawala	RAJSAMAND	Kumbhalgarh	Banas	Banas	MINOR	25.254195	73.798142				0.39					66.00	
2767	Govil	RAJSAMAND	Kumbhalgarh	Banas	Banas	MINOR	25.102655	73.724703				0.28					51.00	
2772	Jawahar Sagar	RAJSAMAND	Kumbhalgarh	Banas	Banas	MINOR	25.235790	73.681968				0.57					92.00	
2773	Jawalia	RAJSAMAND	Kumbhalgarh	Banas	Banas	MINOR	25.333914	73.813320				0.15					28.00	
2782	Kelwara	RAJSAMAND	Kumbhalgarh	Banas	Banas	MINOR	25.120975	73.593673				0.59					168.00	
2801	Mewaria	RAJSAMAND	Kumbhalgarh	Banas	Banas	MINOR	25.233336	73.696958				1.14					194.00	
2814	Rinched	RAJSAMAND	Kumbhalgarh	Banas	Banas	MINOR	25.207788	73.736842				0.90					109.00	
2822	Sathia	RAJSAMAND	Kumbhalgarh	Banas	Banas	MINOR	25.291759	73.750467				0.25					32.00	
2827	Taladri	RAJSAMAND	Kumbhalgarh	Banas	Banas	MINOR	25.111555	73.657709				0.57					101.00	
2836	Thoria	RAJSAMAND	Kumbhalgarh	Banas	Banas	Minor	25.131143	73.725005				0.22					63.00	
2830	Umerwas	RAJSAMAND	Kumbhalgarh	Banas	Banas	MINOR	25.337313	73.715968				0.75					76.00	
2837	Vanka	RAJSAMAND	Kumbhalgarh	Banas	Banas	Minor	25.272813	73.782909				0.31					48.00	
2745	Bharai	RAJSAMAND	Railmagra	Banas	Banas	MINOR	24.994842	74.070453				5.58					1,093.00	
2755	Chokri	RAJSAMAND	Railmagra	Banas	Banas	MINOR	25.044125	74.032069				0.62					121.00	
2775	Junda	RAJSAMAND	Railmagra	Banas	Banas	MINOR	25.100282	74.148258				0.28					80.00	
2784	Khandel	RAJSAMAND	Railmagra	Banas	Banas	MINOR	25.117056	74.094933				1.70					324.00	
2793	Lalpura	RAJSAMAND	Railmagra	Banas	Banas	MINOR	25.079266	74.019365				0.38					54.34	
2750	Binol	RAJSAMAND	Rajsamand	Banas	Banas	MINOR	25.140052	73.953419				0.44					58.00	
2759	Deori Kheda	RAJSAMAND	Rajsamand	Banas	Banas	MINOR	25.131211	73.959023				2.77					396.11	
2789	Kunwaria	RAJSAMAND	Rajsamand	Banas	Banas	MINOR	25.122519	74.014554				0.56					80.08	
2813	Ranjeet Sagar	RAJSAMAND	Rajsamand	Banas	Banas	MINOR	25.039268	73.900849				0.76					217.00	
2820	Sanghat	RAJSAMAND	Rajsamand	Banas	Banas	MINOR	25.080175	73.742266				1.11					249.00	
2825	Sukhai	RAJSAMAND	Rajsamand	Banas	Banas	MINOR	25.086518	73.826412				0.61					147.00	
2826	Swaroop Sagar	RAJSAMAND	Rajsamand	Banas	Banas	MINOR	25.069952	73.848034				1.10					101.00	
2887	Bagruwala	SAWAI MADHOPUR	Khandar	Banas	Banas	Minor	25.996440	76.630533	NA	1,463.00	0.29	0.29	NA	NA	Petakast	NA	30.00	NA
2888	Bamanwala	SAWAI MADHOPUR	Khandar	Banas	Banas	Minor	25.999620	76.647596	NA	1,646.00	1.00	1.00	NA	NA	Petakast	NA	20.00	NA
2856	Galai Sagar	SAWAI MADHOPUR	Khandar	Banas	Banas	MINOR	26.036206	76.579302	5.41	2,200.00	8.16	0.16	NA	220.74	43.00	1,736.00	1,733.00	657.00
2838	Adalwara	SAWAI MADHOPUR	Sawai Madhopur	Banas	Banas	MINOR	26.075374	76.236243	NA	1,097.00	0.55	0.60	NA	NA	0.80	NA	105.00	NA
2844	Bhagwat Garh	SAWAI MADHOPUR	Sawai Madhopur	Banas	Banas	MINOR	26.134570	76.262580			7.21	7.21					1,365.00	
2847	Bhulanwala	SAWAI MADHOPUR	Sawai Madhopur	Banas	Banas	MINOR	25.959722	76.250833	5.50	2,730.00	0.59	0.59	NA	105.50	2.10	150.00	145.00	134.00
2858	Girdarpura	SAWAI MADHOPUR	Sawai Madhopur	Banas	Banas	MINOR	26.093591	76.227444	NA	1,067.00	0.24	0.24	NA	NA	Petakast	NA	68.00	NA
2890	Hajari wala	SAWAI MADHOPUR	Sawai Madhopur	Banas	Banas	Minor	26.033713	76.463348	NA	NA	0.49	0.49	NA	36.79	NA	NA	20.00	NA
2866	Mui	SAWAI MADHOPUR	Sawai Madhopur	Banas	Banas	MINOR	25.958435	76.272256	6.40	914.00	1.18	1.18	NA	1,865.50	10.50	940.00	1,788.00	414.00
3011	Aakodia	TONK	Deoli	Banas	Banas	MINOR	25.847909	75.538269	4.45	2,086.00	0.44	0.44	0.10	1,862.00	5.61	332.00	210.10	111.00
3041	Chandi Sagar	TONK	Deoli	Banas	Banas	MINOR	25.764825	75.499086	3.81	1,165.00	0.57	0.57	0.15	2,351.00	Small W.Course	202.42	129.50	80.97
3046	Danta Sagar	TONK	Deoli	Banas	Banas	MINOR	25.753842	75.448908	1.52	1,413.00	0.30	0.28	0.20	1,069.00	0.91	83.00	65.00	60.77
3056	Dooni Sagar	TONK	Deoli	Banas	Banas	MINOR	25.853179	75.591292			1.42	1.42					303.50	
3177	Haripura	TONK	Deoli	Banas	Banas	Minor	25.914826	75.797949	5.03	892.00	0.85	0.85	0.17	4,800.00	3.80	121.45	97.13	5.66
3182	Kala Talab Mundiya	TONK	Deoli	Banas	Banas	Minor	25.862218	75.506275	3.04	1,798.00	0.17	0.17	0.06	791.00	1.22	73.00	40.50	24.00

S. No.	Project Name	District	Block	Basin	Sub-basin	Class	Latitude (DD)	Longitude (DD)	Ht. above Lowest Foundation (m)	Length of Dam (m)	Gross Storage Capacity (Mm^3)	Live Storage Capacity (Mm^3)	Reservoir Area at FRL (km^2)	Design Spilway Capacity (cusecs)	Length of Canal System (km)	Command Area (ha)		
																GCA	CCA	ICA
1	2	3	4	5	6	7	9	10	11	12	13	14	15	16	17	18	19	20
3079	Kalanada	TONK	Deoli	Banas	Banas	MINOR	25.802104	75.400722	3.28	1,568.00	0.36	0.40	0.11	1,148.00	0.91	123.48	74.10	49.39
3083	Kasir	TONK	Deoli	Banas	Banas	MINOR	25.819399	75.378683	3.09	2,221.00	0.42	0.42	0.14	1,700.00	0.30		149.00	
3113	Nagaja	TONK	Deoli	Banas	Banas	MINOR	25.814545	75.575629	4.42	744.00	0.52	0.47	0.11	1,668.00	1.83	134.41	112.90	67.20
3112	Nasirda	TONK	Deoli	Banas	Banas	MINOR	25.941667	75.363889	4.50	2.70	1.61	1.61	5.67	79.00		405.00	352.10	226.72
3116	Nayagaon	TONK	Deoli	Banas	Banas	MINOR	25.832081	75.604967	2.00	905.00	1.13	1.13	0.57	3,494.00	3.40	340.00	285.00	200.00
3121	Panwar Sagar	TONK	Deoli	Banas	Banas	MINOR	25.781993	75.407216	5.70	3.84	4.06	4.05	10.24	173.00		1,447.00	868.00	599.19
3132	Ram Sagar Lamba	TONK	Deoli	Banas	Banas	MINOR	25.889826	75.794878	6.45		2.86	2.86	6.52	156.00		1,259.00	714.70	429.15
3145	Sangram Sagar	TONK	Deoli	Banas	Banas	MINOR	25.805831	75.506231			0.94	0.95					310.80	
3151	Sarkawas	TONK	Deoli	Banas	Banas	MINOR	25.948459	75.597875	2.13	1,081.00	0.42	0.45	0.21	413.00	1.46	101.21	64.80	63.56
3152	Sawat Sagar	TONK	Deoli	Banas	Banas	MINOR	25.757204	75.444356				0.18					36.40	
3169	Thanwala	TONK	Deoli	Banas	Banas	MINOR	25.914089	75.329065	5.10	1.92	3.40	3.00	10.02	120.00	10.20	1,215.00	777.00	485.83
3018	Baneria Naya	TONK	Todaraisingh	Banas	Banas	MINOR	26.097314	75.570511			0.64	0.64					122.00	
3019	Baneria Purana	TONK	Todaraisingh	Banas	Banas	MINOR	26.070096	75.568170			0.20	1.70					82.00	
3024	Bayla	TONK	Todaraisingh	Banas	Banas	MINOR	26.103409	75.513193	3.96	1,249.00	0.38	0.38	0.10	790.00	1.70	80.97	60.70	54.25
3032	Bibolav	TONK	Todaraisingh	Banas	Banas	MINOR	26.029167	75.587500	3.66	1,432.00	0.40	0.40	0.11	1,583.00	0.60	166.00	80.90	58.29
3039	Botunda	TONK	Todaraisingh	Banas	Banas	MINOR	25.910982	75.486062	3.40	2.97	0.91	0.91	4.92	12.00		1,618.00	156.00	242.91
3042	Chhan	TONK	Todaraisingh	Banas	Banas	MINOR	26.074491	75.634307	3.35	1,722.00	0.51	0.51	0.15	4,240.00	1.43	214.57	1,012.00	68.82
3052	Dhareda Sagar	TONK	Todaraisingh	Banas	Banas	MINOR	26.116320	75.449024				2.86					501.80	
3048	Dhbru Sagar	TONK	Todaraisingh	Banas	Banas	MINOR	26.062409	75.601344				1.75					306.00	
3180	Dhibru Sagar	TONK	Todaraisingh	Banas	Banas	Minor	26.052919	75.623822			1.78	1.78					304.00	
3058	Falolav Kukar	TONK	Todaraisingh	Banas	Banas	MINOR	26.106209	75.470376			0.16	0.17					68.80	
3061	Ganeta Sagar	TONK	Todaraisingh	Banas	Banas	MINOR	26.041074	75.562358	5.79	1,749.00	1.30	1.30	0.22	6,144.00	14.48	506.00	222.60	182.18
3181	Ghareda Sagar	TONK	Todaraisingh	Banas	Banas	Minor	26.108616	75.487265	6.90	1.47	2.88	2.88	5.92	32.00	18.18	907.00	501.80	412.15
3069	Harbhagatpur	TONK	Todaraisingh	Banas	Banas	MINOR	26.119918	75.613833	2.44	1,387.00	0.16	0.17	0.07	813.00	Small W.Course	32.00	24.30	23.00
3075	Islampura	TONK	Todaraisingh	Banas	Banas	MINOR	26.074880	75.625130	3.65	1,015.00		0.52	0.06	5,534.00	Small W.Course	243.00	72.80	101.00
3087	Kherda Sagar	TONK	Todaraisingh	Banas	Banas	MINOR	26.029167	75.616667	3.04	1,868.00	0.34	0.34	0.11	1,152.00	0.73	146.00	101.00	49.00
3088	Kherli Sagar	TONK	Todaraisingh	Banas	Banas	MINOR	26.060587	75.492522			0.41	0.41					77.00	
3107	Modiyala	TONK	Todaraisingh	Banas	Banas	MINOR	26.057484	75.622934			0.17	0.17					24.30	
3101	Morbhatiyan	TONK	Todaraisingh	Banas	Banas	MINOR	26.014310	75.640513	3.35	1,394.00	0.23	0.23	0.07	600.00	Small W.Course	32.00	24.00	24.00
3114	Naya Talab Gadia	TONK	Todaraisingh	Banas	Banas	MINOR	26.106227	75.590400	3.35	1,402.00	0.45	0.45	0.14	792.00	1.67	226.72	145.70	64.77
3130	Ram Nagar Morla	TONK	Todaraisingh	Banas	Banas	MINOR	26.029167	75.541667	3.04	1,800.00	0.52	0.48	0.17	1,937.00	Small W.Course	47.00	47.00	47.00
3135	Rampura	TONK	Todaraisingh	Banas	Banas	MINOR	25.944335	75.492934	3.04	1,620.00	0.29	0.28	0.11	1,200.00	Small W.Course	113.00	68.00	41.00
3136	Rathoria	TONK	Todaraisingh	Banas	Banas	MINOR	26.013303	75.490807	4.88	941.00	0.26	0.25	0.06	720.00	1.20	49.00	40.50	41.00
3137	Ratwara	TONK	Todaraisingh	Banas	Banas	MINOR	26.086491	75.508759	2.44	1,706.00	0.17	0.17	0.07	580.00	0.76	55.00	32.30	22.00
3142	Sadarpura	TONK	Todaraisingh	Banas	Banas	MINOR	26.125316	75.547811	2.74	1,372.00	0.54	0.20	0.03	813.00	0.30	85.00	53.00	28.00
3143	Salbhyawas	TONK	Todaraisingh	Banas	Banas	MINOR	25.967167	75.501665	5.79	1,354.00	0.66	0.65	0.11	3,707.00	1.67	255.00	125.50	94.73
3144	Sandla	TONK	Todaraisingh	Banas	Banas	MINOR	26.045890	75.492000	3.05	1,240.00	1.25	1.24	0.14	2,153.00	Small W.Course	356.27	202.30	182.18
3013	Arnimal	TONK	Tonk	Banas	Banas	MINOR	26.065761	75.792929	3.05	1,432.00	0.17	0.17	0.06	1,118.00	Small W.Course	60.72	36.40	16.20
3035	Bishanpura	TONK	Tonk	Banas	Banas	MINOR	26.022817	75.869474	4.27	1,372.00	0.34	0.34	0.08	1,658.00	3.81	125.50	48.60	24.29
3040	Chandalai	TONK	Tonk	Banas	Banas	MINOR	26.110155	75.808588	NA	3,353.00	4.53	4.53	NA	564.21	5.70	863.00	1,295.00	558.00
3044	Dakhiya	TONK	Tonk	Banas	Banas	MINOR	26.023903	75.736957	7.01	1,280.00	8.12	8.12	8.27	297.29	12.19	2,591.00	1,619.00	981.00
3047	Daulat Sagar	TONK	Tonk	Banas	Banas	MINOR	26.268541	75.823463	5.40	11.52	4.28	5.13	11.62	297.00	2.04	1,830.00	1,092.70	445.34
3050	Deopura	TONK	Tonk	Banas	Banas	MINOR	26.158333	75.891667	3.04	1,372.00	0.20	0.20	0.07	1,510.00	Small W.Course	70.85	36.40	20.24
3071	Harchandera	TONK	Tonk	Banas	Banas	MINOR	26.112575	75.887954	4.57	1,688.00	0.79	0.74	0.16	1,708.00	1.50	307.70	121.40	113.36
3072	Hathona	TONK	Tonk	Banas	Banas	MINOR	26.237500	75.908333	3.96	853.00	0.76	0.76	0.19	2,828.00	1.34	182.18	128.50	109.31
3092	Lamba	TONK	Tonk	Banas	Banas	MINOR	26.060181	75.761890	3.96	2,256.00	0.68	0.68	0.17		Small W.Course	242.91	245.00	97.16
3096	Lawadar	TONK	Tonk	Banas	Banas	MINOR	26.033352	75.836031	4.27	1,737.00	0.68	0.68	0.16		Small W.Course	234.82	153.80	97.16
3123	Parli	TONK	Tonk	Banas	Banas	MINOR	26.133333	75.737500	3.35	3,048.00	0.37	0.37	0.11		Small W.Course	101.21	44.50	40.48
3141	Rustamganj	TONK	Tonk	Banas	Banas	MINOR	26.099803	75.836373	3.96	2,347.00	0.76	0.76	0.19	2,797.00	Small W.Course	300.00	149.70	109.31
3147	Sankhali	TONK	Tonk	Banas	Banas	MINOR	26.150163	75.752568	3.66	2,134.00	0.23	0.23	0.06	793.00	Small W.Course	85.00	53.00	20.24
3148	Sankhana	TONK	Tonk	Banas	Banas	MINOR	25.964652	75.723829	3.35	3,871.00	1.81	1.81	0.54	2,257.00	Small W.Course	287.44	287.30	161.94
3162	Sohela	TONK	Tonk	Banas	Banas	MINOR	26.250362	75.848731	3.66	1,737.00	0.23	0.23	0.06	1,580.00	1.60	85.00	56.70	40.48

S. No.	Project Name	District	Block	Basin	Sub-basin	Class	Latitude (DD)	Longitude (DD)	Ht. above Lowest Foundation (m)	Length of Dam (m)	Gross Storage Capacity (Mm^3)	Live Storage Capacity (Mm^3)	Reservoir Area at FRL (km^2)	Design Spilway Capacity (cusecs)	Length of Canal System (km)	Command Area (ha)		
																GCA	CCA	ICA
1	2	3	4	5	6	7	9	10	11	12	13	14	15	16	17	18	19	20
3175	Vazeerpura	TONK	Tonk	Banas	Banas	MINOR	25.957777	75.771601	3.66	1,554.00	0.79	0.79	0.22		Small W.Course	308.00	137.60	113.36
3012	Agrabilas Pura	TONK	Uniara	Banas	Banas	MINOR	25.950736	75.872475	3.28	1,708.00	0.20	0.20	0.06	280.00	1.60	62.75	40.50	28.34
3178	Balapura	TONK	Uniara	Banas	Banas	Minor	25.886062	75.862570	3.66	3,442.00	0.45	0.45	0.12	2,230.00	2.40	129.55	105.20	64.77
3021	Banetha	TONK	Uniara	Banas	Banas	MINOR	26.068071	75.998874	3.28	1,417.00	0.68	0.68	0.21		1.60	141.70	141.60	97.16
3026	Barana	TONK	Uniara	Banas	Banas	MINOR	26.005008	76.202772	3.28	1,554.00	0.45	0.45	0.14	1,118.00	Small W.Course	141.70	89.00	64.77
3025	Begum Sagar	TONK	Uniara	Banas	Banas	MINOR	25.950000	76.208333	3.95	1,675.00	0.85	0.85	0.22	1,640.00	Small W.Course	222.67	172.00	121.45
3028	Bhanpura	TONK	Uniara	Banas	Banas	MINOR	25.954273	75.888910	3.90	3.30	1.58	1.58	7.00	170.00	5.00	213.00	500.00	306.07
3036	Bishanpura-II	TONK	Uniara	Banas	Banas	MINOR	25.973078	76.235487	4.26	1,461.00	0.42	0.34	0.08	1,658.00	Small W.Course	125.50	48.50	48.58
3037	Borkhandi Khurd	TONK	Uniara	Banas	Banas	MINOR	25.961613	75.842941	4.57	853.00	0.51	0.51	0.11	790.00	Small W.Course	242.91	125.50	80.97
3043	Choru Sagar	TONK	Uniara	Banas	Banas	MINOR	25.967830	76.167083	3.66	2,223.00	0.85	1.42	0.39	2,223.00	Small W.Course	323.88	283.30	202.43
3049	Deopura	TONK	Uniara	Banas	Banas	MINOR	25.957514	75.791159	3.28	1,609.00	0.28	0.28	0.09	660.00	1.60	101.21	53.00	40.48
3057	Dudi Sagar	TONK	Uniara	Banas	Banas	MINOR	25.976563	76.162805	4.50	2.58	1.47	1.47	5.77	62.00		364.00	303.50	62.75
3063	Gothra	TONK	Uniara	Banas	Banas	MINOR	25.966283	75.902877	3.66	2,484.00	1.10	1.10	0.30	3,100.00	3.20	396.76	186.20	157.89
3073	Hedripura	TONK	Uniara	Banas	Banas	MINOR	26.014042	76.226420	3.28	1,737.00	0.48	0.49	0.15	1,118.00	Small W.Course	141.70	101.20	68.82
3082	Kandel Sagar	TONK	Uniara	Banas	Banas	MINOR	25.965295	76.204316	3.96	3,242.00	1.44	1.44	0.36	2,333.00	Small W.Course	263.15	232.70	165.18
3084	Kedli Sagar	TONK	Uniara	Banas	Banas	MINOR	25.937500	76.066667	4.57	984.00	0.91	0.91	0.20	2,490.00	Small W.Course	303.64	202.30	129.55
3095	Lassaria	TONK	Uniara	Banas	Banas	MINOR	25.973290	76.200648	3.96	1,870.00	0.42	0.43	0.11	1,640.00	Small W.Course	121.45	80.90	60.72
3108	Mohammad garh	TONK	Uniara	Banas	Banas	MINOR	25.931412	75.935280	4.00	2.10	1.96	1.95	8.63	49.00	3.00	591.00	319.70	279.35
3109	Mohd Ganj	TONK	Uniara	Banas	Banas	MINOR	25.922047	75.963407	4.57	2,224.00	0.37	0.40	0.08	134.00	Small W.Course	113.36	60.10	52.63
3140	Roopwas	TONK	Uniara	Banas	Banas	MINOR	26.075941	75.946127	6.00	1,350.00	1.45	3.25	0.24	4,438.00	Small W.Course	140.00	266.00	60.00
3163	Soonthra	TONK	Uniara	Banas	Banas	MINOR	26.005952	75.980605	4.80	2.70	2.66	2.66	9.41	83.00	5.00	1,278.00	552.00	380.16
3173	Vijay Garh	TONK	Uniara	Banas	Banas	MINOR	25.945460	75.832320	3.35	2,408.00	0.65	0.65	0.19	3,440.00	1.60	145.74	153.40	93.11
3185	Amarchandia	UDAIPUR	Bargaon	Banas	Banas	MINOR	24.851027	73.594170				0.82					120.00	
3204	Bhutala	UDAIPUR	Bargaon	Banas	Banas	MINOR	24.800299	73.593221				0.28					53.00	
3250	Kathar	UDAIPUR	Bargaon	Banas	Banas	MINOR	24.879167	73.579167				0.77					99.00	
3269	Losing	UDAIPUR	Bargaon	Banas	Banas	MINOR	24.797549	73.628799				0.65					127.00	
3192	Barwara Anicut	UDAIPUR	Gogunda	Banas	Banas	MINOR	24.902778	73.555556				0.28					48.00	
3193	Bateri	UDAIPUR	Gogunda	Banas	Banas	MINOR	24.985371	73.431446				0.34					32.00	
3208	Chalwa	UDAIPUR	Gogunda	Banas	Banas	MINOR	24.805012	73.476809				0.28					36.00	
3231	Gunawal	UDAIPUR	Gogunda	Banas	Banas	MINOR	24.991295	73.507510				0.34					81.00	
3285	Nandesma	UDAIPUR	Gogunda	Banas	Banas	MINOR	24.812631	73.455477				0.59					136.00	
3287	Obra	UDAIPUR	Gogunda	Banas	Banas	MINOR	24.785825	73.516922				0.42					86.00	
3295	Rane Rao	UDAIPUR	Gogunda	Banas	Banas	MINOR	24.747061	73.522724				0.26					38.00	
3297	Rao Madara	UDAIPUR	Gogunda	Banas	Banas	MINOR	24.801708	73.434621				0.31					65.00	
	Sub Basin Total										**144.09**	**278.82**				**36,589.12**	**59,950.75**	**16,167.14**
1045	Akhey Sagar Badnora	BHILWARA	Kotri	Banas	Berach	MINOR	25.200190	74.845733				0.74					149.00	
1047	Ama Tank	BHILWARA	Kotri	Banas	Berach	MINOR	25.198068	74.789160				0.14					28.00	
1131	Chandangarh	BHILWARA	Kotri	Banas	Berach	MINOR	25.229658	74.881823				0.28					54.00	
1145	Choudhariyas	BHILWARA	Kotri	Banas	Berach	MINOR	25.209100	74.828537				0.81					168.00	
1384	Ranwas	BHILWARA	Kotri	Banas	Berach	MINOR	25.217174	74.808666				0.23					72.00	
1430	Sutepa	BHILWARA	Kotri	Banas	Berach	MINOR	25.186218	74.833992				0.96					182.00	
1089	Barundani	BHILWARA	Mandalgarh	Banas	Berach	MINOR	25.162844	74.937043				1.03					197.00	
1148	Damti Kokra	BHILWARA	Mandalgarh	Banas	Berach	MINOR	25.154764	75.138161				4.30					923.00	
1150	Danhltokni	BHILWARA	Mandalgarh	Banas	Berach	MINOR	25.161410	75.131852				4.26					793.00	
1167	Deria	BHILWARA	Mandalgarh	Banas	Berach	MINOR	25.183333	74.950000				3.65					696.00	
1199	Genoli	BHILWARA	Mandalgarh	Banas	Berach	MINOR	25.207108	75.129237				0.63					140.00	
1210	Govta	BHILWARA	Mandalgarh	Banas	Berach	MINOR	25.169624	75.052311				10.00					1,620.00	
1238	Jaleshwar	BHILWARA	Mandalgarh	Banas	Berach	MINOR	25.204183	75.098843				0.59					112.00	
1478	Shyam sagar	BHILWARA	Mandalgarh	Banas	Berach	Minor	25.163138	74.989781				0.25					67.00	
1177	Dhola Danta	BHILWARA	Suwana	Banas	Berach	MINOR	25.183496	74.732762				0.86					169.00	
1390	Rupalia	BHILWARA	Suwana	Banas	Berach	MINOR	25.184930	74.740343				0.83					152.00	
1583	Belod	CHITTAURGARH	Bari Sadri	Banas	Berach	MINOR	24.438757	74.409920				0.31					117.00	
1616	Khok Parsob	CHITTAURGARH	Bari Sadri	Banas	Berach	MINOR	24.360800	74.490818				2.11					250.00	
1640	Parsoli	CHITTAURGARH	Bari Sadri	Banas	Berach	MINOR	24.364309	74.443680	9.28	160.00	2.77	2.31		281.76	3.05	441.00	400.00	331.00
1647	Resdri	CHITTAURGARH	Bari Sadri	Banas	Berach	MINOR	24.335831	74.426148				0.38					51.00	

S. No.	Project Name	District	Block	Basin	Sub-basin	Class	Latitude (DD)	Longitude (DD)	Ht. above Lowest Foundation (m)	Length of Dam (m)	Gross Storage Capacity (Mm^3)	Live Storage Capacity (Mm^3)	Reservoir Area at FRL (km^2)	Design Spilway Capacity (cusecs)	Length of Canal System (km)	Command Area (ha)		
																GCA	CCA	ICA
1	2	3	4	5	6	7	9	10	11	12	13	14	15	16	17	18	19	20
1660	Shivpura	CHITTAURGARH	Bari Sadri	Banas	Berach	MINOR	24.417613	74.414315				0.12					20.00	
1591	Bujra	CHITTAURGARH	Begun	Banas	Berach	MINOR	25.091510	74.924657	9.20	1,160.00	1.11	1.01	0.05	138.00	2.58	231.00	212.00	190.00
1606	Jognia Mata	CHITTAURGARH	Begun	Banas	Berach	MINOR	25.078880	75.102445				0.24					47.00	
1615	Khile Kheria	CHITTAURGARH	Begun	Banas	Berach	MINOR	25.025466	74.839023				0.10					27.00	
1618	Kisumde	CHITTAURGARH	Begun	Banas	Berach	MINOR	25.060097	75.030126				0.33					65.00	
1672	Modia Mahadev	CHITTAURGARH	Begun	Banas	Berach	Minor	25.080038	75.022971	10.86	430.00	3.11	2.92		593.40	13.20	723.00	334.41	334.00
1573	Badhasar	CHITTAURGARH	Bhadesar	Banas	Berach	MINOR	24.604003	74.469155				1.27					20.00	
1598	Gangaria	CHITTAURGARH	Bhadesar	Banas	Berach	MINOR	24.693426	74.486237	7.82	0.24	1.99	1.91	-	33.00	6.60	253.00	233.00	116.19
1685	Hamja Kheri	CHITTAURGARH	Bhadesar	Banas	Berach	Minor	24.752466	74.476464	20.35	1,085.00	5.49	4.63		426.00	5.16	802.00	643.00	643.00
1611	Kannoj Tank	CHITTAURGARH	Bhadesar	Banas	Berach	MINOR	24.751233	74.534326				0.36					65.00	
1619	Kunny	CHITTAURGARH	Bhadesar	Banas	Berach	MINOR	24.754795	74.487282				0.33					68.00	
1621	Luharia	CHITTAURGARH	Bhadesar	Banas	Berach	MINOR	24.704738	74.334338	10.20	2,835.00	2.92	2.83		299.05	5.76	760.00	647.00	405.00
1648	Revlia	CHITTAURGARH	Bhadesar	Banas	Berach	MINOR	24.831429	74.429054	5.39	1,146.00	1.19	1.19	81.00	55.00	2.05	248.99	235.00	136.00
1651	Rudan	CHITTAURGARH	Bhadesar	Banas	Berach	MINOR	24.726124	74.440895				1.24					263.00	
1579	Bari	CHITTAURGARH	Bhopalsagar	Banas	Berach	MINOR	24.889573	74.175007				0.23					40.00	
1600	Gulabpura	CHITTAURGARH	Bhopalsagar	Banas	Berach	MINOR	24.917338	74.178750	6.80	2,061.00	1.14	1.04	76.00	140.00	4.20	384.21	298.00	124.00
1603	Jashma I	CHITTAURGARH	Bhopalsagar	Banas	Berach	MINOR	24.953379	74.234299	5.03	1,512.00	1.19	1.20	90.00	28.00	4.20	236.03	210.00	136.00
1604	Jashma II	CHITTAURGARH	Bhopalsagar	Banas	Berach	MINOR	24.939417	74.216681	5.24	1,991.00	0.77	0.76	52.00	79.00	1.95	193.93	174.00	81.00
1605	Jasrol	CHITTAURGARH	Bhopalsagar	Banas	Berach	MINOR	24.893476	74.201715				0.82					159.00	
1626	Mikol	CHITTAURGARH	Bhopalsagar	Banas	Berach	MINOR	24.848098	74.136473				0.91					173.00	
1633	Nilod	CHITTAURGARH	Bhopalsagar	Banas	Berach	MINOR	24.760619	74.129477	6.10	1,130.00	0.91	0.90	76.00	84.00	2.65	234.01	207.00	144.00
1639	Pari	CHITTAURGARH	Bhopalsagar	Banas	Berach	MINOR	24.809660	74.169874	5.11	1,332.00	0.23	0.21	3.00	34.00	2.00	101.21	40.00	24.00
1641	Patodia	CHITTAURGARH	Bhopalsagar	Banas	Berach	MINOR	24.798928	74.160395	8.68	1,176.00	1.50	1.50	0.07	45.00	3.15	376.00	351.00	172.00
1644	Raipuria	CHITTAURGARH	Bhopalsagar	Banas	Berach	MINOR	24.739849	74.215684	5.72	2,234.00	0.67	0.61	5.00	170.00	2.00	165.99	138.00	90.00
1680	Usrol	CHITTAURGARH	Bhopalsagar	Banas	Berach	Minor	24.884581	74.206246	5.18	1,624.00	0.82	0.82	65.00	56.00	2.55	172.87	156.00	118.00
1568	Amtalia	CHITTAURGARH	Chittaurgarh	Banas	Berach	MINOR	24.957431	74.612148				0.51					82.00	
1575	Banakiya Tank	CHITTAURGARH	Chittaurgarh	Banas	Berach	MINOR	24.904579	74.495685	12.92	2,190.00	9.44	9.26		848.20	16.77	1,790.00	1,692.00	1,325.00
1580	Barkhera Tank	CHITTAURGARH	Chittaurgarh	Banas	Berach	MINOR	24.887788	74.728577	10.75	0.84	1.60	1.60	-	135.94	5.10	303.00	280.00	182.19
1587	Bharkia	CHITTAURGARH	Chittaurgarh	Banas	Berach	MINOR	24.962856	74.690069				0.42					106.00	
1593	Dehikhera	CHITTAURGARH	Chittaurgarh	Banas	Berach	MINOR	24.917452	74.806106				0.71					135.00	
1595	Dhana Khera	CHITTAURGARH	Chittaurgarh	Banas	Berach	MINOR	24.838137	74.490452				0.54					123.00	
1670	Guner	CHITTAURGARH	Chittaurgarh	Banas	Berach	Minor	24.823209	74.848761	11.95	665.00	0.84	0.79	36.09	152.82		327.00	264.00	140.48
1614	Kashmore	CHITTAURGARH	Chittaurgarh	Banas	Berach	MINOR	24.906570	74.549758				0.70					59.00	
1637	Palka Tank	CHITTAURGARH	Chittaurgarh	Banas	Berach	MINOR	24.800000	74.666667				0.24					68.00	
1650	Rud Khera	CHITTAURGARH	Chittaurgarh	Banas	Berach	MINOR	25.030990	74.720003				0.20					20.00	
1677	Ruparel	CHITTAURGARH	Chittaurgarh	Banas	Berach	Minor	24.826419	74.523932	19.50	1,030.00	9.71	8.75	213.00	654.00	14.37	1,640.00	1,437.00	1,222.00
1654	Sadi Tank	CHITTAURGARH	Chittaurgarh	Banas	Berach	MINOR	24.893549	74.752468				1.70					312.00	
1656	Sankal Khera	CHITTAURGARH	Chittaurgarh	Banas	Berach	MINOR	24.844692	74.784056	14.76	55.00	3.17	3.08	6.10	315.00	NA	628.90	526.00	480.00
1678	Shadi	CHITTAURGARH	Chittaurgarh	Banas	Berach	Minor	24.898521	74.750697	6.67	1,770.00	2.15	1.97		220.76	7.86	330.00	202.00	202.00
1582	Basa Khera	CHITTAURGARH	Dungla	Banas	Berach	MINOR	24.480021	74.348313				0.20					42.00	
1599	Ghora Khera	CHITTAURGARH	Dungla	Banas	Berach	MINOR	24.651290	74.363220				0.67					96.00	
1601	Idara Tank	CHITTAURGARH	Dungla	Banas	Berach	MINOR	24.580356	74.271004	4.77	1.31	1.17	0.72	-	183.00	2.20	172.00	158.00	94.74
1622	Magawali Tank	CHITTAURGARH	Dungla	Banas	Berach	MINOR	24.640547	74.286492				1.11					215.00	
1623	Mangalwad	CHITTAURGARH	Dungla	Banas	Berach	MINOR	24.581528	74.293776				1.50					230.00	
1674	Nagawali	CHITTAURGARH	Dungla	Banas	Berach	Minor	24.642555	74.286520	6.05	1.52	1.22	1.11	-	190.00	1.53	237.00	129.55	129.55
1676	Ramakhera	CHITTAURGARH	Dungla	Banas	Berach	Minor	24.640661	74.354076	10.64	1.31	0.75	0.68	-	45.60	2.49	165.00	76.11	76.11
1657	Sanwariya Sarowar	CHITTAURGARH	Dungla	Banas	Berach	MINOR	24.585865	74.414739	20.15	2,360.00	5.41	5.20		512.00	5.88	1,511.00	1,307.00	741.00
1578	Banndani	CHITTAURGARH	Gangrar	Banas	Berach	MINOR	25.153411	74.743199				0.83					328.00	
1581	Baroda	CHITTAURGARH	Gangrar	Banas	Berach	MINOR	24.970953	74.556271				4.66					372.00	
1584	Bhagat Sagar	CHITTAURGARH	Gangrar	Banas	Berach	MINOR	25.039774	74.614904				0.28					65.00	
1585	Bhajal sagar	CHITTAURGARH	Gangrar	Banas	Berach	MINOR	25.055802	74.600165				0.28					285.00	
1589	Borana	CHITTAURGARH	Gangrar	Banas	Berach	MINOR	24.997923	74.564370				1.11					170.00	
1590	Borda	CHITTAURGARH	Gangrar	Banas	Berach	MINOR	24.968522	74.529469	11.70	1,905.00	5.05	4.16	301.00	573.00	12.00	1,520.00	1,412.00	583.00
1671	Kanwalia	CHITTAURGARH	Gangrar	Banas	Berach	Minor	25.094853	74.717371				0.99					141.57	
1617	Kholova	CHITTAURGARH	Gangrar	Banas	Berach	MINOR	24.991572	74.537223				0.17					27.00	
1636	Noliyas	CHITTAURGARH	Gangrar	Banas	Berach	MINOR	25.182950	74.718975				0.31					60.00	
1675	Odwadia	CHITTAURGARH	Gangrar	Banas	Berach	Minor	25.152904	74.743553	7.98	1,387.00	1.04	1.00	104.41	519.00	2.91		215.00	136.00
1653	Ruplia	CHITTAURGARH	Gangrar	Banas	Berach	MINOR	25.165332	74.729681				0.83					252.00	
1655	Salera	CHITTAURGARH	Gangrar	Banas	Berach	MINOR	24.979225	74.629663	9.55	1,355.00	4.25	4.16	0.08	279.00	6.00	633.00	588.00	379.00
1663	Soniyana (a)	CHITTAURGARH	Gangrar	Banas	Berach	MINOR	25.140569	74.668425	11.70	2,213.00	6.80	6.23	0.29	725.00	14.00	2,656.00	1,094.00	447.00
1569	Arnia	CHITTAURGARH	Kapasan	Banas	Berach	MINOR	24.846807	74.344245	8.70	1,176.00	2.04	1.98	0.15	302.00	7.60	479.00	442.00	284.00
1571	Bada Banakiya	CHITTAURGARH	Kapasan	Banas	Berach	MINOR	24.972226	74.483781	5.03	1,624.00	0.64	0.64	34.00	54.00	1.35	204.05	161.00	73.00
1572	Badariya Khera	CHITTAURGARH	Kapasan	Banas	Berach	MINOR	24.926106	74.342589				0.10					20.00	
1574	Bamaniya	CHITTAURGARH	Kapasan	Banas	Berach	MINOR	24.932352	74.295170				1.20					20.00	
1594	Dhamana	CHITTAURGARH	Kapasan	Banas	Berach	MINOR	24.962132	74.285892	7.53	1,340.00	1.59	1.53	74.00	154.00	6.35	387.00	373.00	136.00
1607	Kacholia	CHITTAURGARH	Kapasan	Banas	Berach	MINOR	24.890754	74.374157	5.00	876.00	1.28	1.02	84.00	71.00	4.00	148.18	133.00	92.00
1609	Kalyanpura	CHITTAURGARH	Kapasan	Banas	Berach	MINOR	24.859177	74.248274	5.52	1,322.00	0.32	0.31	29.00	31.00	1.00	72.87	69.00	36.00

S. No.	Project Name	District	Block	Basin	Sub-basin	Class	Latitude (DD)	Longitude (DD)	Ht. above Lowest Foundation (m)	Length of Dam (m)	Gross Storage Capacity (Mm^3)	Live Storage Capacity (Mm^3)	Reservoir Area at FRL (km^2)	Design Spilway Capacity (cusecs)	Length of Canal System (km)	Command Area (ha)		
																GCA	CCA	ICA
1	2	3	4	5	6	7	9	10	11	12	13	14	15	16	17	18	19	20
1610	Kankaria	CHITTAURGARH	Kapasan	Banas	Berach	MINOR	24.903640	74.410096	9.80	1,991.00	1.59	1.50	0.01	91.00	6.50	440.00	413.00	195.00
1612	Kapasan	CHITTAURGARH	Kapasan	Banas	Berach	MINOR	24.895345	74.308284	5.80	1,710.00	7.09	5.94	548.00	205.00	6.60	1,255.00	1,012.00	680.00
1625	Mevda	CHITTAURGARH	Kapasan	Banas	Berach	MINOR	24.893509	74.258202	8.38	2,479.00	2.18	2.01	0.17	381.00	6.60	553.00	323.00	201.00
1627	Modda	CHITTAURGARH	Kapasan	Banas	Berach	MINOR	24.885931	74.276554				1.73					335.00	
1628	Mungana	CHITTAURGARH	Kapasan	Banas	Berach	MINOR	24.873341	74.267326	5.79	1,130.00	0.78	0.78	56.00	97.00	3.00	227.13	175.00	89.00
1634	Nimbahera(ii)	CHITTAURGARH	Kapasan	Banas	Berach	MINOR	24.916446	74.373810				0.13					53.00	
1635	Ningarya	CHITTAURGARH	Kapasan	Banas	Berach	MINOR	24.781677	74.377445				0.03					20.00	
1638	Pandali	CHITTAURGARH	Kapasan	Banas	Berach	MINOR	24.929489	74.429293				0.08					20.00	
1642	Pindoli	CHITTAURGARH	Kapasan	Banas	Berach	MINOR	24.882381	74.393415				4.10					675.00	
1645	Randiyain Sandiyan	CHITTAURGARH	Kapasan	Banas	Berach	MINOR	24.971809	74.382552	6.80	1,065.00	0.50	0.44	219.00	91.58	1.05		104.00	63.00
1649	Rewaliyan	CHITTAURGARH	Kapasan	Banas	Berach	MINOR	24.820433	74.389306				1.19					227.00	
1652	Rudari	CHITTAURGARH	Kapasan	Banas	Berach	MINOR	24.822470	74.357054	4.80	1,512.00	1.52	1.39	88.00	94.00	2.88	403.64	184.00	159.00
1658	Saropa	CHITTAURGARH	Kapasan	Banas	Berach	MINOR	24.974858	74.437758	7.50	1,137.00	3.40	3.14	0.13	161.00	7.50	626.00	606.00	314.00
1679	Singpur	CHITTAURGARH	Kapasan	Banas	Berach	Minor	24.931908	74.457178	3.95	5,490.00	0.97	0.88	0.02	688.18	3.42	250.00	200.00	193.00
1681	Wagli	CHITTAURGARH	Kapasan	Banas	Berach	Minor	24.714750	74.296855	9.75	1,710.00	1.93	1.98		23.26	6.57	433.00	388.00	271.00
1576	Bandoli	CHITTAURGARH	Nimbahera	Banas	Berach	MINOR	24.740550	74.841661				0.10					20.00	
1669	Barkheri	CHITTAURGARH	Nimbahera	Banas	Berach	Minor	24.644308	74.743047				1.47					182.19	
1673	Murlia	CHITTAURGARH	Nimbahera	Banas	Berach	Minor	24.705756	74.641722				8.46					1,210.53	
1646	Rani Khera	CHITTAURGARH	Nimbahera	Banas	Berach	MINOR	24.597906	74.676756				0.66					125.00	
1664	Sowe	CHITTAURGARH	Nimbahera	Banas	Berach	MINOR	24.723187	74.565166				0.28					53.00	
1666	Uncha	CHITTAURGARH	Nimbahera	Banas	Berach	MINOR	24.577188	74.627038	7.92	1,768.00	2.61	2.50		255.00	5.00	820.00	723.00	243.00
1570	Bada Bamania	CHITTAURGARH	Rashmi	Banas	Berach	MINOR	24.991675	74.427068				0.89					135.00	
1577	Banina	CHITTAURGARH	Rashmi	Banas	Berach	MINOR	25.017203	74.467567	4.48	1,713.00	1.73	1.64	125.00	135.00	4.20	259.92	251.00	171.00
1588	Bhimgarh	CHITTAURGARH	Rashmi	Banas	Berach	MINOR	25.017850	74.426835				0.04					20.00	
1668	Wokril Sagar	CHITTAURGARH	Rashmi	Banas	Berach	MINOR	24.980557	74.360149				0.28					53.00	
2702	Asinda	PRATAPGARH	Chhoti Sadri	Banas	Berach	MINOR	24.465346	74.742329				1.40					303.00	
2703	Badi Mansarowar	PRATAPGARH	Chhoti Sadri	Banas	Berach	MINOR	24.486906	74.661472	14.75	304.00	9.48	8.42		661.00	12.80	1,850.00	1,503.00	1,325.00
2706	Basera Lower	PRATAPGARH	Chhoti Sadri	Banas	Berach	MINOR	24.469534	74.667181				1.56					340.00	
2717	Kesunda	PRATAPGARH	Chhoti Sadri	Banas	Berach	MINOR	24.446690	74.730422	7.40	0.12	0.96	0.90	-	65.09	1.50	162.00	146.00	101.21
2766	Godach	RAJSAMAND	Khamnor	Banas	Berach	MINOR	24.788494	73.665132				0.35					69.00	
2778	Kagmadarda	RAJSAMAND	Khamnor	Banas	Berach	MINOR	24.830498	73.730124				0.75					101.00	
2805	Morio Kadia	RAJSAMAND	Khamnor	Banas	Berach	MINOR	24.781230	73.763327				0.28					42.00	
2752	Chapri	RAJSAMAND	Railmagra	Banas	Berach	MINOR	24.914691	74.141547				0.34					69.00	
2753	Charna	RAJSAMAND	Railmagra	Banas	Berach	MINOR	24.907726	74.085825				0.59					121.00	
2763	Dhilli	RAJSAMAND	Railmagra	Banas	Berach	MINOR	24.913204	74.023963				0.82					110.00	
2783	Ketral Lalies	RAJSAMAND	Railmagra	Banas	Berach	MINOR	24.931393	74.152897				0.06					20.00	
2799	Menduria	RAJSAMAND	Railmagra	Banas	Berach	MINOR	24.918710	74.099968				0.62					88.66	
2821	Sansera	RAJSAMAND	Railmagra	Banas	Berach	MINOR	24.952936	74.065205				4.87					696.41	
3188	Badi	UDAIPUR	Bargaon	Banas	Berach	MINOR	24.609169	73.624464				7.08					883.00	
3212	Chirwa	UDAIPUR	Bargaon	Banas	Berach	MINOR	24.702257	73.741021				0.37					105.00	
3220	Fatehsagar	UDAIPUR	Bargaon	Banas	Berach	MINOR	24.608824	73.674699				6.70					680.00	
3264	Lakhawali	UDAIPUR	Bargaon	Banas	Berach	MINOR	24.675742	73.682784				2.41					176.00	
3271	Madar (Big)	UDAIPUR	Bargaon	Banas	Berach	MINOR	24.680126	73.605418				2.21					280.00	
3272	Madar (Samll)	UDAIPUR	Bargaon	Banas	Berach	MINOR	24.664060	73.607266				0.77					77.00	
3197	Bhatewar	UDAIPUR	Bhindar	Banas	Berach	MINOR	24.611089	74.014481				1.64					106.00	
3198	Bhatt	UDAIPUR	Bhindar	Banas	Berach	MINOR	24.602442	74.208197				3.51					522.00	
3236	Hinta	UDAIPUR	Bhindar	Banas	Berach	MINOR	24.566080	74.179619				0.45					69.00	
3278	Mangli	UDAIPUR	Bhindar	Banas	Berach	MINOR	24.625551	74.244134				0.43					135.00	
3322	Unthyala (kamoya)	UDAIPUR	Bhindar	Banas	Berach	MINOR	24.674058	73.995137				1.02					171.00	
3229	Goverdhan Vilas	UDAIPUR	Girwa	Banas	Berach	MINOR	24.542658	73.681066				0.26					77.00	
3284	Nandeshwar	UDAIPUR	Girwa	Banas	Berach	MINOR	24.520040	73.642981				3.54					506.22	
3316	Swaroop Sagar	UDAIPUR	Girwa	Banas	Berach	MINOR	24.570723	73.660770				9.01					1,288.43	
3274	Madarda	UDAIPUR	Gogunda	Banas	Berach	MINOR	24.742352	73.607881				0.40					71.00	
3205	Bika Kheda	UDAIPUR	Mavli	Banas	Berach	MINOR	24.765873	74.072857				0.28					55.00	
3209	Changeri	UDAIPUR	Mavli	Banas	Berach	MINOR	24.838048	74.101930				0.62					81.00	
3219	Dundiya	UDAIPUR	Mavli	Banas	Berach	MINOR	24.657235	74.185888				1.93					396.00	
3222	Gangela (Palana)	UDAIPUR	Mavli	Banas	Berach	MINOR	24.817882	73.864431				0.57					175.00	
3223	Ghasa	UDAIPUR	Mavli	Banas	Berach	MINOR	24.787179	73.811728				5.84					677.00	
3232	Gundali	UDAIPUR	Mavli	Banas	Berach	MINOR	24.695492	73.789562				0.20					28.00	
3256	Khartana	UDAIPUR	Mavli	Banas	Berach	MINOR	24.862428	74.052237				4.05					805.00	
3257	Khemli	UDAIPUR	Mavli	Banas	Berach	MINOR	24.680106	73.850416				2.07					298.00	
3266	Laxman Sagar (Nawa)	UDAIPUR	Mavli	Banas	Berach	MINOR	24.769960	73.800350				0.37					95.00	
3291	Patolia	UDAIPUR	Mavli	Banas	Berach	MINOR	24.785568	73.996270				1.35					287.00	
3296	Rani Kheda	UDAIPUR	Mavli	Banas	Berach	MINOR	24.849854	74.008609				0.37					50.00	
3302	Salera	UDAIPUR	Mavli	Banas	Berach	MINOR	24.677657	73.920113				1.73					319.00	
3324	Vasni	UDAIPUR	Mavli	Banas	Berach	MINOR	24.795776	74.052010				0.40					74.00	
	Sub Basin Total										**118.99**	**257.79**				**25,806.94**	**44,556.08**	**13,808.48**

S. No.	Project Name	District	Block	Basin	Sub-basin	Class	Latitude (DD)	Longitude (DD)	Ht. above Lowest Foundation (m)	Length of Dam (m)	Gross Storage Capacity (Mm^3)	Live Storage Capacity (Mm^3)	Reservoir Area at FRL (km^2)	Design Spilway Capacity (cusecs)	Length of Canal System (km)	Command Area (ha)		
																GCA	CCA	ICA
1	2	3	4	5	6	7	9	10	11	12	13	14	15	16	17	18	19	20
2	Ajgara Bund	AJMER	Arain	Banas	Dain	MINOR	26.002275	75.084148	NA	NA	3.53	3.25	NA	396.20		809.00	485.60	388.31
9	Amolav Jhelalalai	AJMER	Arain	Banas	Dain	MINOR	26.053398	75.082408	3.88	1,560.00	0.68	0.68	NA	38.06	NA	138.87	97.00	77.70
10	Amolav Tank Hingonia	AJMER	Arain	Banas	Dain	MINOR	26.066535	75.124914	5.02	1,770.00	0.68	0.68	NA	32.83	NA	138.87	97.10	77.70
11	Ana Sagar Fatehgarh	AJMER	Arain	Banas	Dain	MINOR	26.125029	75.011857	3.65	1,350.00	0.34	2.60	NA	20.23	NA	89.60	364.20	34.81
35	Bada Talab Sarana	AJMER	Arain	Banas	Dain	MINOR	26.086084	74.981758	4.57	1,950.00	0.32	0.31	NA	123.39	NA	56.65	54.00	45.75
49	Bala Sagar Bhatolav	AJMER	Arain	Banas	Dain	MINOR	26.059208	75.034782	4.26	1,710.00	0.85	0.85	NA	55.18	NA	184.90	129.50	103.60
50	Bala Sagar Bilawatiya	AJMER	Arain	Banas	Dain	MINOR	26.066084	75.147523	3.65	1,890.00	0.90	0.90	NA	29.15	NA	184.94	129.50	103.60
77	Bhagwatia Tank	AJMER	Arain	Banas	Dain	MINOR	26.096868	74.981002	NA	NA	0.45	0.45	NA	15.99	0.45	88.00	64.80	130.00
79	Bhawani Sagar Bhagwanpura	AJMER	Arain	Banas	Dain	MINOR	26.013366	74.971263	4.57	1,500.00	1.39	1.20	NA	75.70	NA	198.30	198.30	158.64
98	Chandolai Tank	AJMER	Arain	Banas	Dain	MINOR	26.164758	75.063062	4.11	1,350.00	0.26	0.30	NA	27.45	NA	89.03	41.30	41.29
137	Gaj Sagar Sarovar	AJMER	Arain	Banas	Dain	MINOR	26.084992	75.022727	NA	NA	1.95	1.95	NA	63.96	4.80	394.00	259.00	279.00
138	Gambhir Sagar	AJMER	Arain	Banas	Dain	MINOR	26.048235	75.106032	4.87	1,350.00	0.34	0.34	NA	60.56	NA	48.58	49.00	38.86
151	Govind Sagar Sarwar	AJMER	Arain	Banas	Dain	MINOR	26.081662	74.985083	NA	NA	1.50	1.50	NA	63.96	4.29	302.80	173.00	130.00
166	Jarjodia Tank	AJMER	Arain	Banas	Dain	MINOR	26.093374	75.003637	NA	NA	0.29	0.28	NA	38.06	3.27		32.00	52.00
185	Kalyani Sagar Dhuwalia	AJMER	Arain	Banas	Dain	MINOR	26.035880	75.155452	3.65	1,440.00	0.31	0.30	NA	20.94	2.83	40.08	40.10	40.08
191	Kanwar Pada Talab Birla	AJMER	Arain	Banas	Dain	MINOR	26.146493	75.109139	4.26	1,500.00	0.45	0.50	NA	27.45	NA	89.03	64.80	51.82
197	Keria Sagar Keria	AJMER	Arain	Banas	Dain	MINOR	26.353426	74.973801	3.50	1,500.00	0.32	0.25	NA	33.31	NA	189.87	189.80	45.75
234	Madan Sarowar Dhanwa	AJMER	Arain	Banas	Dain	MINOR	26.156316	75.032187	NA	NA	9.13	8.80	NA	1,590.46	18.40	1,767.80	1,258.60	1,245.70
259	Naya Talab Barana	AJMER	Arain	Banas	Dain	MINOR	26.184563	75.026056	4.11	1,650.00	0.62	0.60	NA	67.63	NA	64.77	64.80	51.82
262	Naya Talab Birla	AJMER	Arain	Banas	Dain	MINOR	26.159192	75.094408	4.26	2,550.00	0.90	0.90	NA	103.30	NA	184.94	129.50	103.60
273	Naya Talab Piproli	AJMER	Arain	Banas	Dain	MINOR	26.086313	75.125115	3.05	1,530.00	0.45	0.45	NA	56.60	NA	89.03	64.80	51.82
314	Ram Sagar Ramsinghpura	AJMER	Arain	Banas	Dain	MINOR	26.188578	75.062686	3.81	1,350.00	0.68	0.68	NA	42.45	NA	89.06	89.00	76.89
333	Sadapura Tank	AJMER	Arain	Banas	Dain	MINOR	26.178308	75.080321	4.41	1,500.00	0.20	0.20	NA	63.67	NA	94.69	85.00	50.60
358	Sindoor Sagar	AJMER	Arain	Banas	Dain	MINOR	26.068470	75.016461	NA	NA	1.90	1.90	NA	57.93	4.39	236.80	214.50	32.00
364	Sura Suri Fatehgarh	AJMER	Arain	Banas	Dain	MINOR	26.115669	75.006731	3.65	2,490.00	0.45	0.45	NA	40.89	NA	89.03	64.80	50.60
367	Suraj Sagar Jatpura	AJMER	Arain	Banas	Dain	MINOR	26.109874	75.085800	4.26	1,200.00	0.45	0.50	NA	24.00	NA	89.03	64.80	51.82
372	Tal Sarowar Arnia	AJMER	Arain	Banas	Dain	MINOR	25.997204	75.023302				5.43					777.00	
378	Vijai Sagar Fatehgarh	AJMER	Arain	Banas	Dain	MINOR	26.131736	75.002173	NA	NA	2.55	2.55	NA	121.69	8.88	520.00	364.20	291.38
1	Aheda Talab	AJMER	Bhinay	Banas	Dain	MINOR	26.248715	74.918424	4.76	2,430.00	0.98	0.99	NA	42.19	NA	224.44	204.00	121.41
4	Akhai Sanar Bandanwara	AJMER	Bhinay	Banas	Dain	MINOR	26.143966	74.701740	4.92	2,550.00	0.37	0.37	NA	38.12	NA	186.16	182.10	60.70
8	Amertiya Talab Goyala	AJMER	Bhinay	Banas	Dain	MINOR	26.130022	74.913394	4.26	1,170.00	0.18	0.18	NA	29.15	NA	36.43	32.70	32.38
12	Anand Sagar Tantoti	AJMER	Bhinay	Banas	Dain	MINOR	26.147566	74.818180	4.11	2,100.00	0.26	0.25	NA	15.56	NA	89.03	80.90	50.60
15	Bada Talab Anawar	AJMER	Bhinay	Banas	Dain	MINOR	26.165813	74.888534				0.20					61.00	
16	Bada Talab Bandanwara	AJMER	Bhinay	Banas	Dain	MINOR	26.143553	74.738268	5.18	2,880.00	0.51	0.51	NA	93.39	NA	84.98	80.00	72.87
17	Bada Talab Billia	AJMER	Bhinay	Banas	Dain	MINOR	25.987214	74.908753	3.96	1,260.00	0.21	0.21	NA	24.34	NA	36.42	32.40	30.36
20	Bada Talab Goyla	AJMER	Bhinay	Banas	Dain	MINOR	26.118605	74.935644	3.58	1,950.00	0.27	0.27	NA	30.76	NA	93.08	89.00	38.04
22	Bada Talab Jaipia	AJMER	Bhinay	Banas	Dain	MINOR	26.098154	74.617186	3.50	660.00	0.14	0.14	NA	18.62	NA	32.37	28.30	21.05
23	Bada Talab Jawalakakua	AJMER	Bhinay	Banas	Dain	MINOR	26.145260	74.893837	4.11	2,700.00	0.71	0.71	NA	49.66	NA	125.45	121.40	102.02
29	Bada Talab Nagolav	AJMER	Bhinay	Banas	Dain	MINOR	26.024740	74.861331				0.41					68.80	
32	Bada Talab Paranga	AJMER	Bhinay	Banas	Dain	MINOR	26.084446	74.654426	3.66	1,590.00	0.42	0.42	NA	35.49	NA	54.65	53.00	48.58
33	Bada Talab Pipla	AJMER	Bhinay	Banas	Dain	MINOR	26.007145	74.837412	4.62	1,545.00	0.28	0.28	NA	26.09	NA	80.96	73.00	40.48
38	Bada Talab Sedariya	AJMER	Bhinay	Banas	Dain	MINOR	26.107500	74.745833	3.65	1,290.00	0.20	0.20	NA	15.31	NA	52.61	48.00	36.36
40	Bada Talab Suklia	AJMER	Bhinay	Banas	Dain	MINOR	26.215752	74.842839	3.35	2,340.00	0.29	0.28	NA	27.70	NA	52.61	49.00	42.10
41	Bada Talab Tilara	AJMER	Bhinay	Banas	Dain	MINOR	26.010958	74.744466	3.96	1,800.00	0.33	0.31	NA	71.74	NA	117.36	60.70	46.55
386	Badla Khera talab	AJMER	Bhinay	Banas	Dain	Minor	26.168717	74.936115				0.06					14.00	
45	Bahadur Sagar Jadana	AJMER	Bhinay	Banas	Dain	MINOR	26.049495	74.971825	3.50	1,200.00	0.19	0.20	NA	13.86	NA	36.42	32.40	24.29
47	Bahera Talab	AJMER	Bhinay	Banas	Dain	MINOR	26.248163	74.899587	3.56	1,920.00	0.37	0.37	NA	65.37	NA	186.97	168.40	101.17
52	Bala Sagar Nagolav	AJMER	Bhinay	Banas	Dain	MINOR	26.014767	74.859409	4.87	930.00	0.27	0.25	NA	39.20	NA	44.52	41.00	30.36
56	Balwant Sagar Kushalpura	AJMER	Bhinay	Banas	Dain	MINOR	26.073899	74.857650	3.35	1,440.00	0.23	0.23	NA	30.36	NA	32.37	28.00	24.29
57	Balwant Sagar Sabri	AJMER	Bhinay	Banas	Dain	MINOR	26.016753	74.783069	4.87	1,350.00	0.81	0.79	NA	59.06	NA	133.55	129.50	115.34
62	Bankey Sagar Sarwar	AJMER	Bhinay	Banas	Dain	MINOR	26.057972	74.978934	NA	NA	1.73	1.73	NA	86.88	2.40	348.00	125.50	153.00
63	Bankhera Talab Badagaon	AJMER	Bhinay	Banas	Dain	MINOR	26.004833	74.909492	4.26	1,650.00	0.70	0.70	NA	49.27	NA	186.16	182.10	101.21
64	Banvala Talab Surapura	AJMER	Bhinay	Banas	Dain	MINOR	26.134025	74.736205				0.31					48.00	
65	Barol Tank (New)	AJMER	Bhinay	Banas	Dain	MINOR	26.245162	74.959780				3.10					647.50	
66	Barol Tank (Old)	AJMER	Bhinay	Banas	Dain	MINOR	26.259030	74.978443	4.70	1,740.00	0.46	0.30	NA	63.96	NA	191.21	101.20	60.72
72	Bhabut Sager Shergarh	AJMER	Bhinay	Banas	Dain	MINOR	26.195069	74.954170	3.88	1,200.00	0.25	0.25	NA	57.96	NA	78.91	65.00	60.72
76	Bhagwant Pura Talab	AJMER	Bhinay	Banas	Dain	MINOR	26.224630	74.890420	4.81	1,050.00	0.35	0.23	NA	27.59	NA	101.17	101.20	60.70
83	Bhera Sagar Sukhll	AJMER	Bhinay	Banas	Dain	MINOR	26.189992	74.858418	4.03	2,070.00	0.31	0.31	NA	57.95	NA	52.63	49.00	43.72
84	Bheru Sagar Bherukheda	AJMER	Bhinay	Banas	Dain	MINOR	26.121375	74.867073	3.50	1,318.00	0.25	0.25	NA	23.49	NA	64.77	64.80	60.72
86	Bheru Sagar Ramalia	AJMER	Bhinay	Banas	Dain	MINOR	26.116645	74.830520	4.26	1,560.00	0.15	0.20	NA	23.66	NA	34.39	30.40	22.26
103	Chawandia Sagar Chawandia	AJMER	Bhinay	Banas	Dain	MINOR	26.025178	74.732698	5.64	1,209.00	1.24	1.20	NA	53.00	NA	182.11	178.10	141.64
106	Chota Talab Sokeli	AJMER	Bhinay	Banas	Dain	MINOR	26.205982	74.871462	3.50	1,860.00	0.33	0.31	NA	40.32	NA	56.65	52.60	44.53
110	Dabela Talab Dabrela	AJMER	Bhinay	Banas	Dain	MINOR	26.220764	75.008688	5.32	2,550.00	1.19	1.13	NA	114.61	NA	562.52	505.60	121.41
114	Dand Talab Sanodia	AJMER	Bhinay	Banas	Dain	MINOR	26.093721	74.916483	3.43	1,770.00	0.27	0.25	NA	18.96	NA	45.50	44.50	38.46
119	Deven Sagar Nagala	AJMER	Bhinay	Banas	Dain	MINOR	26.003780	74.853291	3.96	600.00	0.15	0.14	NA	50.97	NA	36.42	122.00	22.26
124	Devi Sagar Shergarh	AJMER	Bhinay	Banas	Dain	MINOR	26.167322	74.955329	3.50	1,410.00	0.17	0.17	NA	61.32	NA	28.33	24.30	24.29
130	Dhora Talab Jatayan	AJMER	Bhinay	Banas	Dain	MINOR	26.085621	74.853621	3.65	2,010.00	0.17	0.17	NA	40.92	NA	32.37	26.30	26.31

S. No.	Project Name	District	Block	Basin	Sub-basin	Class	Latitude (DD)	Longitude (DD)	Ht. above Lowest Foundation (m)	Length of Dam (m)	Gross Storage Capacity (Mm^3)	Live Storage Capacity (Mm^3)	Reservoir Area at FRL (km^2)	Design Spilway Capacity (cusecs)	Length of Canal System (km)	Command Area (ha)		
																GCA	CCA	ICA
1	2	3	4	5	6	7	9	10	11	12	13	14	15	16	17	18	19	20
134	Dund Talab Goyela	AJMER	Bhinay	Banas	Dain	MINOR	26.116639	74.915318	3.43	1,380.00	0.17	0.17	NA	21.85	NA	32.37	28.20	24.29
140	Ganesh Sagar Ganeshpura	AJMER	Bhinay	Banas	Dain	MINOR	26.131882	74.967704	3.65	1,530.00	0.68	0.70	NA	24.33	NA	138.81	97.10	77.70
148	Gopal Sagar Sarana	AJMER	Bhinay	Banas	Dain	MINOR	26.172122	74.867958	3.96	1,905.00	0.49	0.48	NA	90.41	NA	80.97	76.90	76.92
161	Inder Sagar Kalyanipura	AJMER	Bhinay	Banas	Dain	MINOR	26.131815	74.768809				0.23					33.00	
167	Jaswant Sagar Shergarh	AJMER	Bhinay	Banas	Dain	MINOR	26.171560	74.972975	4.57	1,820.00	0.35	0.29	NA	116.59	NA	68.78	64.80	64.77
173	Jhela Sagar Dhatol	AJMER	Bhinay	Banas	Dain	MINOR	26.095151	74.784285	3.96	1,470.00	0.27	0.30	NA	40.61	NA	48.56	44.50	32.38
174	Jhela Sagar Ragunthgarh	AJMER	Bhinay	Banas	Dain	MINOR	26.072751	74.845340	4.26	1,560.00	0.24	0.25	NA	64.86	NA	48.48	40.50	34.81
180	Kala Talab Barla	AJMER	Bhinay	Banas	Dain	MINOR	26.047598	74.851458	4.32	2,670.00	0.57	0.57	NA	84.42	NA	129.50	121.40	80.97
181	Kala Talab Keria	AJMER	Bhinay	Banas	Dain	MINOR	26.050523	74.892551	3.96	1,050.00	0.17	0.17	NA	39.76	NA	45.50	40.50	24.29
182	Kala Talab Ragunathpura	AJMER	Bhinay	Banas	Dain	MINOR	26.017289	74.933858	4.26	720.00	0.20	0.20	NA	13.86	NA	36.42	32.40	28.34
183	Kala Talab Satolia	AJMER	Bhinay	Banas	Dain	MINOR	26.077585	74.898547	3.58	2,070.00	0.37	0.37	NA	9.85	NA	60.70	56.70	52.63
192	Karan Sagar Piproli	AJMER	Bhinay	Banas	Dain	MINOR	26.170146	74.831277	3.81	1,950.00	0.57	0.57	NA	39.20	NA	97.73	89.00	18.34
195	Karni Sagar Khapara	AJMER	Bhinay	Banas	Dain	MINOR	26.007064	74.789615	4.26	1,350.00	0.21	0.21	NA	17.71	NA	44.52	40.70	32.38
198	Keria Talab	AJMER	Bhinay	Banas	Dain	MINOR	26.190996	74.978176	3.65	1,260.00	0.25	0.25	NA	15.62	NA	60.72	60.70	36.43
229	Lodkiya Talab Nagolao	AJMER	Bhinay	Banas	Dain	MINOR	26.014608	74.846251	4.26	1,200.00	0.24	0.23	NA	28.04	NA	40.47	36.40	34.00
238	Man Sagar Jadana	AJMER	Bhinay	Banas	Dain	MINOR	26.056187	74.950140	3.88	1,350.00	0.45	0.45	NA	26.60	NA	78.65	72.80	63.35
239	Man Sagar Jatayan	AJMER	Bhinay	Banas	Dain	MINOR	26.080443	74.875861	NA	NA	1.81	1.81	NA	219.04	3.18	532.00	526.10	400.00
250	Mundiya Talab Jawala	AJMER	Bhinay	Banas	Dain	MINOR	26.137136	74.900614	3.88	1,560.00	0.18	0.17	NA	32.20	NA	44.52	40.50	40.48
264	Naya Talab Chandana	AJMER	Bhinay	Banas	Dain	MINOR	26.137523	74.838818	3.73	1,710.00	0.27	0.25	NA	35.17	NA	52.61	48.60	38.05
269	Naya Talab Kanei Kalan	AJMER	Bhinay	Banas	Dain	MINOR	25.982256	74.925398	4.27	1,530.00	0.17	0.17	NA	42.59	NA	40.47	36.40	24.29
274	Naya Talab Ragunathpura	AJMER	Bhinay	Banas	Dain	MINOR	26.005805	74.931690	3.96	1,680.00	0.28	0.28	NA	34.46	NA	125.45	121.40	40.47
276	Naya Talab Satolia	AJMER	Bhinay	Banas	Dain	MINOR	26.069008	74.917238	3.73	1,800.00	0.19	0.20	NA	79.97	NA	52.61	49.00	27.53
283	Panchoula Talab Khandra	AJMER	Bhinay	Banas	Dain	MINOR	26.053011	74.932426	4.27	1,710.00	0.17	0.17	NA	29.15	NA	32.37	28.30	28.34
288	Peevania Talab Keria	AJMER	Bhinay	Banas	Dain	MINOR	26.044992	74.870477	5.38	3,000.00	0.55	0.60	NA	174.61	1.11	182.91	178.10	80.97
289	Peevniya Talab Jotayan	AJMER	Bhinay	Banas	Dain	MINOR	26.096449	74.866370	3.96	1,380.00	0.17	0.12	NA	46.01	NA	33.02	28.40	26.31
301	Prithvi Sagar Gudlia	AJMER	Bhinay	Banas	Dain	MINOR	26.169763	74.812020	3.81	3,210.00	0.42	0.42	NA	44.20	NA	125.45	121.40	97.16
311	Ram Sagar Kumariya	AJMER	Bhinay	Banas	Dain	MINOR	26.172222	74.733333	4.72	1,530.00	0.93	0.93	NA	94.30	NA	145.69	141.60	133.55
318	Rani Sagar Gujarwara	AJMER	Bhinay	Banas	Dain	MINOR	26.091328	74.766333	3.96	660.00	0.70	0.71	NA	46.24	NA	129.50	48.60	101.21
320	Ranjeet Sagar Karanta	AJMER	Bhinay	Banas	Dain	MINOR	26.060236	74.705007	4.72	750.00	0.42	0.42	NA	24.84	NA	101.17	97.10	60.70
331	Roop Sagar Roopura	AJMER	Bhinay	Banas	Dain	MINOR	26.124100	74.666507	3.96	1,200.00	0.14	0.14	NA	49.41	NA	44.52	40.50	24.29
336	Sagar Tank Bawari	AJMER	Bhinay	Banas	Dain	MINOR	26.192161	74.927932	4.26	2,100.00	0.14	0.20	NA	36.25	NA	74.75	60.70	20.65
345	Shell Sagar Kitap	AJMER	Bhinay	Banas	Dain	MINOR	26.134510	74.744982	3.65	3,900.00	1.15	1.16	NA	107.65	NA	234.72	192.00	161.88
346	Shell Sagar Tantoti	AJMER	Bhinay	Banas	Dain	MINOR	26.136984	74.801050	3.50	1,350.00	0.38	0.37	NA	32.20	NA	95.10	91.10	54.15
357	Shyam Sagar Ragunathgarh	AJMER	Bhinay	Banas	Dain	MINOR	26.064739	74.852844	4.26	1,380.00	0.29	0.28	NA	34.50	NA	54.63	50.60	41.70
360	Sohila Tank	AJMER	Bhinay	Banas	Dain	MINOR	26.216667	74.962500	3.96	1,800.00	0.24	0.14	NA	51.50	NA	72.84	64.80	40.48
365	Suraj Sagar Bandanwara	AJMER	Bhinay	Banas	Dain	MINOR	26.122111	74.711914	4.42	930.00	0.45	0.45	NA	69.67	NA	84.98	80.00	64.77
366	Suraj Sagar Bhinai	AJMER	Bhinay	Banas	Dain	MINOR	26.040045	74.752137	5.48	810.00	0.63	0.62	NA	61.89	NA	117.36	111.30	90.65
368	Suraj Sagar Kalyanipura	AJMER	Bhinay	Banas	Dain	MINOR	26.138077	74.760078	3.81	1,440.00	0.34	0.34	NA	39.28	NA	56.65	52.60	40.48
375	Ummed	AJMER	Bhinay	Banas	Dain	MINOR	26.080038	74.701870	4.57	885.00	0.51	0.51	NA	53.34	NA	80.70	33.00	60.72
382	Vijay Sagar Ramalia	AJMER	Bhinay	Banas	Dain	MINOR	26.093269	74.807774	4.65	1,500.00	0.32	0.31	NA	65.80	NA	40.47	36.40	32.38
7	Ambapura	AJMER	Kekri	Banas	Dain	MINOR	26.110743	75.182955	NA	NA	1.95	1.75	NA	917.00		547.00	418.65	251.00
42	Bade Talab Naiki	AJMER	Kekri	Banas	Dain	MINOR	26.015554	75.165266	3.65	1,200.00	0.17	0.20	NA	15.34	4.66	45.74	46.00	45.74
75	Bhagat Saaar Junia	AJMER	Kekri	Banas	Dain	MINOR	26.087410	75.206639	3.96	2,010.00	0.85	0.85	NA	107.26	NA	114.57	115.00	114.57
93	Budia Talab Jal Ka Kheda	AJMER	Kekri	Banas	Dain	MINOR	26.002754	75.162567	3.20	1,050.00	0.23	0.21	NA	11.32	0.70	24.69	24.70	24.69
95	Chak Tank Salari	AJMER	Kekri	Banas	Dain	MINOR	25.964040	75.272585	4.27	1,230.00	0.17	0.17	NA	27.54	NA	24.24	24.30	24.29
100	Chaperiya Tank Gaon	AJMER	Kekri	Banas	Dain	MINOR	26.110755	75.293310	3.81	2,790.00	0.30	0.28	NA	222.72	0.65	36.84	36.80	36.84
120	Devi Sagar Devgaon	AJMER	Kekri	Banas	Dain	MINOR	26.113643	75.274458	3.96	1,680.00	0.51	0.51	NA	41.60	NA	69.23	68.40	69.23
127	Dhawalia Tank Junia	AJMER	Kekri	Banas	Dain	MINOR	26.083359	75.179369	4.87	1,650.00	0.28	0.28	NA	115.10	7.07	36.84	37.00	36.84
128	Dhola Talab Naiki	AJMER	Kekri	Banas	Dain	MINOR	26.010020	75.163678	3.65	960.00	0.17	0.17	NA	10.13	5.36	21.45	21.40	21.45
165	Jarjala Tank Junio	AJMER	Kekri	Banas	Dain	MINOR	26.090886	75.189062	3.50	1,500.00	0.45	0.45	NA	38.06	6.70	89.06	64.80	51.82
203	Khatolai Mewda Kalan	AJMER	Kekri	Banas	Dain	MINOR	25.981562	75.216095				0.37					47.00	
254	Nanga Tank Baghena	AJMER	Kekri	Banas	Dain	MINOR	26.027386	75.286464	3.65	1,140.00	0.31	0.30	NA	28.53	1.15	42.51	42.50	42.51
271	Naya Talab Mevdakalan	AJMER	Kekri	Banas	Dain	MINOR	25.987092	75.168956	3.35	2,310.00	0.57	0.55	NA	43.64	NA	79.35	78.40	79.35
310	Ram Sagar Dhulwatia	AJMER	Kekri	Banas	Dain	MINOR	26.040780	75.194430	3.81	900.00	0.18	0.18	NA	34.41	2.22	23.07	23.10	23.07
349	Shiv Sagar Akelsingha	AJMER	Kekri	Banas	Dain	MINOR	26.024953	75.196609	3.81	1,500.00	0.20	0.20	NA	56.60	3.97	22.26	22.30	22.26
53	Bala Sagar Pharikiya	AJMER	Kishangarh	Banas	Dain	MINOR	26.470392	74.825662	NA	760.00	19.00	0.52	NA	825.00	0.11	187.00	168.80	73.00
206	Kheda Sagar	AJMER	Kishangarh	Banas	Dain	MINOR	26.460520	74.874925	NA	1,980.00	8.00	0.23	NA	1,336.00	1.51	202.00	102.00	53.00
306	Rai Sagar Tikawara	AJMER	Kishangarh	Banas	Dain	MINOR	26.475000	74.850000	NA	1,510.00	21.40	0.59	NA	3,163.00	2.99	72.00	68.80	48.00
26	Bada Talab Mayela	AJMER	Masuda	Banas	Dain	MINOR	26.200834	74.555326	3.96	216.00	0.25	0.25	NA	35.79	1.41	46.00	45.00	36.43
37	Bada Talab Satwaria	AJMER	Masuda	Banas	Dain	MINOR	26.120640	74.621427	5.18	870.00	0.51	0.51	NA	93.78	3.30	90.00	89.00	72.85
43	Badliya Talab Amargarh	AJMER	Masuda	Banas	Dain	MINOR	26.155133	74.632178	3.35	2,130.00	0.34	0.34	NA	52.19	NA	93.07	89.00	64.77
194	Karani Sagar Nasoon	AJMER	Masuda	Banas	Dain	MINOR	26.221788	74.585847	4.27	900.00	0.35	0.40	NA	40.80	2.82	64.80	63.10	50.60
24	Bada Talab Jherwara	AJMER	Peesangan	Banas	Dain	MINOR	26.221647	74.699288				0.71					121.40	
67	Barwala Tank Bagsuri	AJMER	Peesangan	Banas	Dain	MINOR	26.235794	74.660331	NA	710.00	8.50	0.23	NA	1,420.00	2.80	60.00	44.50	28.00
92	Budh Sagar Bagsuri	AJMER	Peesangan	Banas	Dain	MINOR	26.212306	74.631608				1.42					161.90	
96	Chal Tank	AJMER	Peesangan	Banas	Dain	MINOR	26.249577	74.732160				1.42					433.00	
107	Chotta Talab Jherwasa	AJMER	Peesangan	Banas	Dain	MINOR	26.244794	74.690543	NA	910.00	15.00	0.35	NA	1,386.00	1.43	88.00	72.80	40.00

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																GCA	CCA	ICA
1	2	3	4	5	6	7	9	10	11	12	13	14	15	16	17	18	19	20
142	Gaon Talab Bagsuri	AJMER	Peesangan	Banas	Dain	MINOR	26.228067	74.640547	NA	1,790.00	7.50	0.20	NA	1,300.00	2.07	50.00	40.50	24.00
162	Jagpura Talab	AJMER	Peesangan	Banas	Dain	MINOR	26.265819	74.731907				0.59					80.90	
220	Lakholav Tank Hanutiya	AJMER	Peesangan	Banas	Dain	MINOR	26.210499	74.785095				0.85					368.30	
263	Naya Talab Bubania	AJMER	Peesangan	Banas	Dain	MINOR	26.252085	74.681668				1.92					202.30	
281	Pacca Talab Bubania	AJMER	Peesangan	Banas	Dain	MINOR	26.259046	74.670666				0.42					80.90	
293	Phool Sagar Bhawanikhera	AJMER	Peesangan	Banas	Dain	MINOR	26.294286	74.660389	NA	950.00	14.50	0.71	NA	2,047.00	3.56	73.00	101.20	41.00
307	Rajgarh Irrigation Project	AJMER	Peesangan	Banas	Dain	MINOR	26.296745	74.637556				0.57					93.80	
309	Rajoshi Talab	AJMER	Peesangan	Banas	Dain	MINOR	26.332148	74.676078	NA	270.00	26.42	0.80	NA	1,776.00	3.35	202.00	161.90	101.00
323	Rasulpura Tank	AJMER	Peesangan	Banas	Dain	MINOR	26.216688	74.670674	NA	756.00	10.00	0.28	NA	1,088.00	1.67	90.00	80.90	32.00
325	Rata Khera Talab	AJMER	Peesangan	Banas	Dain	MINOR	26.299327	74.756881	NA	100.00	6.09	3.11	NA	4,596.00	1.58	44.00	170.00	24.00
353	Shiv Sagar Niyara	AJMER	Peesangan	Banas	Dain	MINOR	26.178029	74.664194	NA	590.00	5.48	4.40	NA	17,323.00	13.75	820.00	465.40	450.00
34	Bada Talab Ramsar	AJMER	Srinagar	Banas	Dain	MINOR	26.277301	74.838274	NA	2,250.00	14.40	11.40	NA	33,941.00	9.73	1,619.00	1,456.90	809.00
58	Balwanta Talab	AJMER	Srinagar	Banas	Dain	MINOR	26.350248	74.704821	NA	1,083.00	9.26	0.26	NA	975.00	0.48	72.00	65.00	40.00
68	Barwala Tank Pharkiya	AJMER	Srinagar	Banas	Dain	MINOR	26.448209	74.815351				0.50					169.00	
88	Bhim Sagar Tihari	AJMER	Srinagar	Banas	Dain	MINOR	26.409281	74.875446	NA	1,788.00	1.71	1.56	NA	8,452.00	6.64	374.00	338.00	202.00
115	Dandolav Talab Samporda	AJMER	Srinagar	Banas	Dain	MINOR	26.319778	74.950890				0.75					101.20	
135	Dund Talab Ramsar	AJMER	Srinagar	Banas	Dain	MINOR	26.300881	74.878198				0.59					68.00	
158	Hathi Patta Parkiya	AJMER	Srinagar	Banas	Dain	MINOR	26.432823	74.828980	NA	1,920.00	21.28	0.40	NA	3,120.00	1.06	56.00	50.60	30.00
187	Kalyanipura Tank	AJMER	Srinagar	Banas	Dain	MINOR	26.246865	74.873492				0.42					50.60	
190	Kanpura Tank	AJMER	Srinagar	Banas	Dain	MINOR	26.388376	74.847454	NA	1,720.00	87.10	2.41	NA	13,613.00	5.82	281.00	252.90	152.00
199	Kesarpura Talab	AJMER	Srinagar	Banas	Dain	MINOR	26.253565	74.858103	NA	910.00	14.60	0.42	NA	2,464.00	0.70	112.00	101.20	61.00
208	Kheer Samand Ramsar	AJMER	Srinagar	Banas	Dain	MINOR	26.292322	74.873115	NA	1,091.00	0.37	0.34	NA	2,759.00			48.62	
227	Laxmipura Tank	AJMER	Srinagar	Banas	Dain	MINOR	26.268794	74.892152				0.42					52.20	
243	Mawasia Tank	AJMER	Srinagar	Banas	Dain	MINOR	26.284182	74.907116				0.80					202.30	
388	Naya Talab Jilawara	AJMER	Srinagar	Banas	Dain	Minor	26.401411	74.819132	NA	1,250.00	74.43	1.02	NA	5,907.00	3.20	225.00	64.00	133.00
290	Permanand Sagar Jaswantpura	AJMER	Srinagar	Banas	Dain	MINOR	26.233266	74.808667	NA	1,810.00	7.25	0.20	NA	1,675.00	1.85	63.00	56.70	34.00
292	Phool Sagar Beer	AJMER	Srinagar	Banas	Dain	MINOR	26.406067	74.741784	NA	183.00	0.09	3.31	NA	3,813.00	8.27	375.00	337.10	236.00
317	Rambari Talab Ramsar	AJMER	Srinagar	Banas	Dain	MINOR	26.312527	74.891706				0.45					40.50	
319	Rani Sagar Jhilawara	AJMER	Srinagar	Banas	Dain	MINOR	26.406532	74.805398				1.02					145.86	
339	Sanodh Talab	AJMER	Srinagar	Banas	Dain	MINOR	26.280258	74.819957				0.65					236.30	
352	Shiv Sagar Loherwara	AJMER	Srinagar	Banas	Dain	MINOR	26.252576	74.772889				1.13					147.70	
361	Srinagar Tank	AJMER	Srinagar	Banas	Dain	MINOR	26.450553	74.776760	NA	480.00	37.19	0.85	NA	2,580.00	3.96	150.00	135.60	81.00
369	Surajpura Tank	AJMER	Srinagar	Banas	Dain	MINOR	26.307104	74.905192	NA	990.00	28.79	0.70	NA	4,534.00	4.26	151.00	135.60	81.00
3146	Sankarwada	TONK	Deoli	Banas	Dain	MINOR	25.957502	75.378618	3.95	2,011.00	0.28	0.28	0.07	1,350.00	0.61	101.21	40.50	40.48
3015	Bade Talab Datok	TONK	Todaraisingh	Banas	Dain	MINOR	26.142549	75.248105		3,072.00	0.67	0.65	0.20		5.64	246.96	121.40	93.12
3023	Batera Sagar	TONK	Todaraisingh	Banas	Dain	MINOR	26.023935	75.427796	6.09	1,295.00	2.88	1.67	0.28	4,494.00	2.74	242.91	161.90	141.70
3055	Dhodia Sagar Dholai	TONK	Todaraisingh	Banas	Dain	MINOR	26.130124	75.270258	3.96	1,890.00	0.28	0.28	NA	41.17	0.03	40.08	40.00	40.08
3060	Gagolao	TONK	Todaraisingh	Banas	Dain	MINOR	26.067200	75.431786	4.57	1,844.00	0.77	0.77	0.17	2,125.00	2.74	327.97	129.50	110.12
3062	Getolav Sawaliya	TONK	Todaraisingh	Banas	Dain	MINOR	26.181986	75.248335	3.35	1,384.00	0.37	0.37	0.11	345.00	Small W.Course	158.00	68.80	53.00
3064	Guchi Nadi	TONK	Todaraisingh	Banas	Dain	MINOR	26.156986	75.262705	2.74		0.06	0.06	0.02		Small W.Course		19.00	8.00
3080	Kali Dungari	TONK	Todaraisingh	Banas	Dain	MINOR	26.049278	75.386541	3.35	1,767.00	1.56	1.55	0.49	9,372.00	10.51	445.34	287.30	223.60
3086	Khedulla	TONK	Todaraisingh	Banas	Dain	MINOR	26.083440	75.415355	3.35	1,584.00	0.02	0.40	0.11	1,580.00	2.13	152.00	60.70	51.00
3110	Mordund Kuharda	TONK	Todaraisingh	Banas	Dain	MINOR	26.128725	75.211370	2.44	1,539.00	0.18	0.17	0.06		1.82	67.00	39.50	26.00
3126	Pundariya Mundiya	TONK	Todaraisingh	Banas	Dain	MINOR	26.086037	75.353116	3.35	1,848.00	0.14	0.14	0.07	650.00	1.67	73.00	32.40	20.00
3127	Rajalao Kuhara	TONK	Todaraisingh	Banas	Dain	MINOR	26.117639	75.233139	3.35	1,859.00	0.25	0.25	616.30	614.77	2.44	73.00	40.50	28.00
3157	Shiv Sagar Sanwaria	TONK	Todaraisingh	Banas	Dain	MINOR	26.164252	75.244779	3.66	1,402.00	0.31	0.31	0.09	780.00	0.76	93.00	72.80	45.00
3167	Talab Mundiya	TONK	Todaraisingh	Banas	Dain	MINOR	26.061247	75.348745				0.17					40.50	
	Sub Basin Total										**516.63**	**137.35**				**22,393.05**	**22,692.23**	**12,960.26**
2849	Bindawal	SAWAI MADHOPUR	Bonli	Banas	Gudia	MINOR	26.270644	76.123867	NA	NA	0.20	0.18	NA	NA	1.05	1.05	20.20	NA
3029	Bhanwanti	TONK	Niwai	Banas	Gudia	MINOR	26.407161	75.948925	3.66	1,676.00	0.37	0.37	0.10		2.29	157.89	52.60	52.63
3066	Halolao	TONK	Niwai	Banas	Gudia	MINOR	26.383246	75.917681	4.87	1,798.00	0.62	0.62	0.13	1,543.00	Small W.Course	283.40	113.30	113.36
3070	Harbhanwta	TONK	Niwai	Banas	Gudia	MINOR	26.496605	75.986774	3.96	2,317.00	0.54	0.68	0.17	1,486.00	2.28	218.62	97.10	97.16
3078	Jugalpura	TONK	Niwai	Banas	Gudia	MINOR	26.344557	75.979503	3.04		0.68	0.40	0.12		Small W.Course	97.16	50.20	40.00
3097	Luhara North	TONK	Niwai	Banas	Gudia	MINOR	26.474559	75.965512	3.35	2,133.00	0.57	0.57	0.17	1,574.00	2.25	218.62	89.00	71.25
3098	Luhara South	TONK	Niwai	Banas	Gudia	MINOR	26.452152	75.969127	3.35	2,133.00	0.35	0.51	0.10	1,490.00	3.04	206.47	72.80	72.00
3102	Matholao	TONK	Niwai	Banas	Gudia	MINOR	26.332112	75.943820	7.80	2.37	1.75	2.01	3.17	12.00	3.75	283.00	293.30	393.52
3159	Sirohi	TONK	Niwai	Banas	Gudia	MINOR	26.419059	76.077288	3.00	1,158.00	0.55	0.57	0.18	1,950.00	Small W.Course	109.31	95.50	78.13
3165	Sukhpura	TONK	Niwai	Banas	Gudia	MINOR	26.419355	75.982607	4.27	1,554.00	0.68	0.68	0.16	1,114.00	Small W.Course	226.72	141.00	97.00
3122	Parana	TONK	Tonk	Banas	Gudia	MINOR	26.268710	75.954914	5.49	1,798.00	1.05	0.20	0.19	3,226.00	2.29	275.30	198.30	150.00
	Sub Basin Total										**7.36**	**6.79**				**2,077.54**	**1,223.30**	**1,165.05**
2450	Mirmada	KARAULI	Karauli	Banas	Kalisil	MINOR	26.373054	76.944330				0.31					49.00	

S. No.	Project Name	District	Block	Basin	Sub-basin	Class	Latitude (DD)	Longitude (DD)	Ht. above Lowest Foundation (m)	Length of Dam (m)	Gross Storage Capacity (Mm^3)	Live Storage Capacity (Mm^3)	Reservoir Area at FRL (km^2)	Design Spilway Capacity (cusecs)	Length of Canal System (km)	Command Area (ha)		
																GCA	CCA	ICA
1	2	3	4	5	6	7	9	10	11	12	13	14	15	16	17	18	19	20
2425	Attewa	KARAULI	Sapotra	Banas	Kalisil	MINOR	26.266853	76.874385				0.53					283.00	
2431	Daulatpura	KARAULI	Sapotra	Banas	Kalisil	MINOR	26.188674	76.840522				0.29					20.30	
2440	Kalayanpura	KARAULI	Sapotra	Banas	Kalisil	MINOR	26.181104	76.766664				1.30					20.30	
2452	Naineya ki Guwari	KARAULI	Sapotra	Banas	Kalisil	MINOR	26.232409	76.853544				1.10					105.00	
	Sub Basin Total										-	**3.53**				-	**477.60**	-
385	Bada Talab Sapnikheda	AJMER	Arain	Banas	Khari	Minor	25.907451	75.036240	3.65	1,980.00	0.41	0.41	NA	38.18	NA	68.82	38.40	58.70
61	Bankey Sagar Sampla	AJMER	Arain	Banas	Khari	MINOR	25.905021	74.985636	4.57	1,200.00	0.68	0.68	NA	32.51	NA	138.00	97.10	77.70
102	Chawanda Sagar Sarsari	AJMER	Arain	Banas	Khari	MINOR	25.962070	75.088099	3.20	1,770.00	0.14	0.14	NA	9.17	NA	20.23	20.30	20.24
111	Daduliya Mevda Khurd	AJMER	Arain	Banas	Khari	MINOR	25.945193	75.042386				0.28					32.40	
144	Gopal Sagar Gopalpura	AJMER	Arain	Banas	Khari	MINOR	25.890733	75.011358	3.96	1,560.00	0.68	0.68	NA	51.62	NA	138.86	97.10	77.70
145	Gopal Sagar Jalia	AJMER	Arain	Banas	Khari	MINOR	25.950078	75.000901	3.35	1,830.00	0.17	0.17	NA	22.64	NA	138.86	97.10	60.72
157	Hanuman Sagar Sampla	AJMER	Arain	Banas	Khari	MINOR	25.918251	74.984787	3.65	960.00	0.68	0.68	NA	28.30	NA	138.86	97.10	77.70
172	Jhala Sagar Sampla	AJMER	Arain	Banas	Khari	MINOR	25.911074	74.985622	3.65	1,050.00	0.18	0.17	NA	29.60	NA	22.28	22.00	22.26
249	Moti Sagar Sampla	AJMER	Arain	Banas	Khari	MINOR	25.937220	75.017731	3.50	2,580.00	0.68	0.68	NA	62.26	NA	138.86	97.10	76.89
3	Akhai Sagar Bagari	AJMER	Bhinay	Banas	Khari	MINOR	25.926982	74.790524	4.85	2,670.00	0.40	0.40	NA	52.33	NA	84.98	81.00	48.58
18	Bada Talab Chapaneri	AJMER	Bhinay	Banas	Khari	MINOR	25.965490	74.821803	4.88	1,860.00	0.19	0.20	NA	47.06	NA	64.75	60.70	36.43
21	Bada Talab Gudakalan	AJMER	Bhinay	Banas	Khari	MINOR	25.952152	74.879664	4.72	1,440.00	0.23	0.23	NA	42.87	NA	36.42	32.40	24.29
27	Bada Talab Methaniya	AJMER	Bhinay	Banas	Khari	MINOR	26.049384	74.652491	3.35	510.00	0.29	0.28	NA	53.60	NA	84.98	80.90	60.72
30	Bada Talab Nimbeda	AJMER	Bhinay	Banas	Khari	MINOR	25.975583	74.758659	4.27	1,680.00	0.34	0.34	NA	19.32	NA	141.64	137.60	48.58
31	Bada Talab Padlia	AJMER	Bhinay	Banas	Khari	MINOR	25.969329	74.847464	4.27	1,680.00	0.45	0.45	NA	46.01	NA	145.69	141.60	64.77
39	Bada Talab Singhawal	AJMER	Bhinay	Banas	Khari	MINOR	26.027182	74.676853				0.28					291.30	
393	Bhandariya Talab Singhawal	AJMER	Bhinay	Banas	Khari	Minor	26.037330	74.670985	3.96	1,110.00	0.44	0.44	NA	25.95	NA	170.00	170.00	40.58
89	Bhison Sagar Jetpura	AJMER	Bhinay	Banas	Khari	MINOR	25.927255	74.940249	NA	NA	0.55	0.55	NA	22.64	NA	84.98	27.50	78.13
94	Budia Talab Ratakot	AJMER	Bhinay	Banas	Khari	MINOR	26.056880	74.624156	3.05	1,500.00	0.28	0.28	NA	20.91	NA	52.61	49.00	40.58
101	Chawand Sagar Chawandia	AJMER	Bhinay	Banas	Khari	MINOR	25.949519	74.906870	3.66	1,350.00	0.28	0.28	NA	25.78	NA	48.06	44.50	39.67
113	Dand Talab Chapaneri	AJMER	Bhinay	Banas	Khari	MINOR	25.963813	74.833571	2.74	1,110.00	0.35	0.34	NA	12.65	NA	68.80	65.00	54.65
117	Deh Sagar Badli	AJMER	Bhinay	Banas	Khari	MINOR	25.951262	74.739000	NA	NA	2.97	2.97	NA	135.81	17.80	847.60	364.20	463.37
118	Deva Sagar Kachriya	AJMER	Bhinay	Banas	Khari	MINOR	25.932276	74.927302	4.27	1,530.00	0.31	0.31	NA	26.60	NA	64.75	44.50	44.53
121	Devi Sagar Jetpura	AJMER	Bhinay	Banas	Khari	MINOR	25.924529	74.929285	3.66	1,200.00	0.17	0.17	NA	29.40	NA	36.42	26.30	36.31
147	Gopal Sagar Munidakhera	AJMER	Bhinay	Banas	Khari	MINOR	25.933879	74.843671	3.96	2,700.00	0.47	0.45	NA	96.22	NA	84.98	66.80	66.80
150	Govind Sagar Kurthal	AJMER	Bhinay	Banas	Khari	MINOR	25.904311	74.899594	4.27	1,800.00	0.51	0.51	NA	55.01	NA	125.45	72.80	72.87
159	Hindola Talab Ratakot	AJMER	Bhinay	Banas	Khari	MINOR	26.049038	74.616086	3.35	960.00	0.24	0.23	NA	49.80	NA	89.03	86.00	34.40
175	Jhila Bhagwati Devila Kal	AJMER	Bhinay	Banas	Khari	MINOR	25.909519	74.766711	2.74	1,580.00	0.20	0.20	NA	25.95	NA	36.42	34.40	38.34
193	Karani Sagar Hinolia	AJMER	Bhinay	Banas	Khari	MINOR	26.012500	74.662500	3.96	1,050.00	0.65	0.65	NA	76.46	NA	109.26	105.20	93.08
200	Khamcha Talab Kerot	AJMER	Bhinay	Banas	Khari	MINOR	25.878355	74.932246				0.60					87.80	
240	Man Sagar Nandsi	AJMER	Bhinay	Banas	Khari	MINOR	25.938828	74.882196	3.66	1,800.00	0.48	0.48	NA	37.50	NA	89.03	80.90	38.82
245	Mohabat Sagar Devaliya	AJMER	Bhinay	Banas	Khari	MINOR	25.904726	74.770989	3.66	1,050.00	0.18	0.17	NA	14.82	NA	36.42	32.40	24.29
248	Moti Sagar Kerot	AJMER	Bhinay	Banas	Khari	MINOR	25.903134	74.935566	4.57	2,010.00	0.19	0.20	NA	29.80	NA	32.97	28.30	27.53
258	Naya Talab Akelsingh	AJMER	Bhinay	Banas	Khari	MINOR	25.999463	74.717319	4.27	1,290.00	0.45	0.45	NA	33.28	NA	145.69	141.60	129.55
270	Naya Talab Kerot	AJMER	Bhinay	Banas	Khari	MINOR	25.893530	74.938083	4.72	750.00	0.99	0.99	NA	41.09	NA	165.92	141.60	129.55
277	Naya Talab Singhawal	AJMER	Bhinay	Banas	Khari	MINOR	26.035611	74.695634	3.50	810.00	0.28	0.28	NA	30.00	NA	89.06	89.00	80.97
302	Puch Piplia Devaliya	AJMER	Bhinay	Banas	Khari	MINOR	25.917098	74.754169	3.96	2,627.00	0.57	0.57	NA	43.81	NA	97.12	89.00	80.97
304	Raghunath Sagar Badalkher	AJMER	Bhinay	Banas	Khari	MINOR	25.956752	74.796650	3.96	1,620.00	0.31	0.31	NA	91.97	NA	93.07	89.00	52.63
321	Ranjeet Sagar Nast	AJMER	Bhinay	Banas	Khari	MINOR	25.931397	74.876661	4.11	3,690.00	0.64	0.71	NA	42.56	NA	113.31	109.20	103.23
334	Sadhu Sagar Parlia	AJMER	Bhinay	Banas	Khari	MINOR	25.982149	74.900413	4.57	1,275.00	0.20	0.20	NA	26.65	NA	44.52	40.50	29.14
335	Sadul Sagar Khaheda	AJMER	Bhinay	Banas	Khari	MINOR	26.012075	74.683703	3.96	1,050.00	0.22	0.23	NA	19.15	NA	44.52	41.00	32.38
350	Shiv Sagar Chapaner	AJMER	Bhinay	Banas	Khari	MINOR	25.957683	74.833507	5.08	2,670.00	0.64	0.62	NA	46.46	NA	32.28	121.40	29.15
362	Stalao Talab Akelsingh	AJMER	Bhinay	Banas	Khari	MINOR	25.989582	74.718297	4.57	1,050.00	0.18	0.18	NA	37.21	NA	24.29	24.00	20.24
381	Vijay Sagar Khedi	AJMER	Bhinay	Banas	Khari	MINOR	25.893557	74.821836	4.42	3,000.00	0.34	0.28	NA	37.49	NA	56.65	40.50	40.48
14	Bada Talab Aloli	AJMER	Kekri	Banas	Khari	MINOR	25.792872	75.124921	4.26	1,860.00	0.71	1.70	NA	51.62	NA	98.78	310.00	98.78
25	Bada Talab Khera	AJMER	Kekri	Banas	Khari	MINOR	25.920257	75.155664	3.35	3,090.00	0.28	0.28	NA	45.00	NA	38.46	38.40	38.46
28	Bada Talab Molkiya	AJMER	Kekri	Banas	Khari	MINOR	25.925854	75.198611	3.35	1,800.00	0.27	0.25	NA	20.94	NA	38.46	38.40	38.46
59	Bandi Talab Nakikakhed	AJMER	Kekri	Banas	Khari	MINOR	25.935954	75.184176	3.35	1,350.00	0.25	0.26	NA	13.05	NA	39.27	38.80	39.27
69	Basundani Project	AJMER	Kekri	Banas	Khari	MINOR	25.716446	75.109291	7.50	7.50	8.92	8.36	4,591.00	1,240.00	6.33	1,395.40	1,375.60	825.51
71	Bechla Tank Nimod	AJMER	Kekri	Banas	Khari	MINOR	25.906534	75.124083	3.50	1,155.00	0.26	0.25	NA	55.52	NA	37.24	37.20	37.24
97	Chandani Behramwas	AJMER	Kekri	Banas	Khari	MINOR	25.862500	75.037500	3.81	1,860.00	0.42	0.42	NA	75.70	2.89	60.72	37.00	60.72
108	Chotta Talab Mandha	AJMER	Kekri	Banas	Khari	MINOR	25.961106	75.166397	3.65	1,500.00	0.33	0.31	NA	46.70	NA	40.89	40.90	40.89
109	Chotta Talab Molkiya	AJMER	Kekri	Banas	Khari	MINOR	25.925900	75.181067	3.65	1,500.00	0.31	0.31	NA	35.17	3.05	44.53	44.50	44.53
153	Gundalao Talab	AJMER	Kekri	Banas	Khari	MINOR	25.974295	75.179809	17.00	501.00	0.20	0.20		67.52	2.44	29.00	26.70	23.00
186	Kalyani Sagar Fakriya	AJMER	Kekri	Banas	Khari	MINOR	25.875000	75.141667	3.35	2,700.00	0.79	0.79	NA	38.06	NA	114.57	114.50	114.57
188	Kandelav Talab Naikakheda	AJMER	Kekri	Banas	Khari	MINOR	25.938859	75.127043	3.35	2,320.00	0.35	0.35	NA	33.99	2.44	NA	49.80	49.79
189	Kankeria Talab Chatyali	AJMER	Kekri	Banas	Khari	MINOR	25.795105	75.237142	4.11	1,950.00	0.40	0.38	NA	51.87	0.88	54.25	54.20	54.25
212	Kishan Sagar Khewas	AJMER	Kekri	Banas	Khari	MINOR	25.840843	75.064761	3.20	1,560.00	0.31	0.28	NA	22.64	2.55	38.46	38.40	38.46
228	Lodkiya Talab Gordha	AJMER	Kekri	Banas	Khari	MINOR	25.725514	75.118546	3.58	1,290.00	0.20	0.20	NA	19.13	2.86	23.88	27.10	23.84
231	Macholav Talab Kekri	AJMER	Kekri	Banas	Khari	MINOR	25.948055	75.132328	4.57	1,800.00	0.44	0.44	NA	50.32	1.52	65.56	59.10	50.20
247	Morda Talab Kachariya	AJMER	Kekri	Banas	Khari	MINOR	25.850534	75.038713	4.26	2,220.00	0.28	0.28	NA	45.00	NA	40.89	41.00	40.89
252	Naharsagar Piplaj	AJMER	Kekri	Banas	Khari	MINOR	25.743506	75.085105	NA	NA	4.51	4.10	NA	1,190.80	7.05	1,164.00	894.30	468.00

S. No.	Project Name	District	Block	Basin	Sub-basin	Class	Latitude (DD)	Longitude (DD)	Ht. above Lowest Foundation (m)	Length of Dam (m)	Gross Storage Capacity (Mm^3)	Live Storage Capacity (Mm^3)	Reservoir Area at FRL (km^2)	Design Spilway Capacity (cusecs)	Length of Canal System (km)	Command Area (ha)		
																GCA	CCA	ICA
1	2	3	4	5	6	7	9	10	11	12	13	14	15	16	17	18	19	20
265	Naya Talab Gulgaon	AJMER	Kekri	Banas	Khari	MINOR	25.837333	75.157432	3.50	2,190.00	0.20	0.20	NA	54.17	4.11	24.38	24.30	42.28
268	Naya Talab Kaleda	AJMER	Kekri	Banas	Khari	MINOR	25.910175	75.201212	3.65	1,755.00	0.42	0.42	NA	35.17	NA	62.75	62.70	62.75
275	Naya Talab Sadara	AJMER	Kekri	Banas	Khari	MINOR	25.804558	75.160811	3.05	2,095.00	0.38	0.35	NA	46.35	NA	120.19	84.20	46.15
279	Neel Ki Nadi Kekri	AJMER	Kekri	Banas	Khari	MINOR	25.971250	75.149317	3.96	1,650.00	0.18	0.17	NA	40.72	NA	40.48	40.50	40.48
284	Para Bund-II	AJMER	Kekri	Banas	Khari	MINOR	25.861429	75.127211	NA	NA	4.04	3.81	NA	345.26		1,192.60	962.10	572.64
285	Para Bund-I	AJMER	Kekri	Banas	Khari	MINOR	25.892012	75.171464	NA	NA	4.44	4.16	NA	341.27	3.00	1,073.70	942.30	566.44
297	Piplaj	AJMER	Kekri	Banas	Khari	MINOR	25.739940	75.106339				4.52					894.00	
322	Ranjeet Sagar Pranhara	AJMER	Kekri	Banas	Khari	MINOR	25.892263	75.054795	4.11	2,580.00	1.23	1.13	NA	148.97	3.00	259.80	231.40	161.88
337	Sakal Sagar Khewas	AJMER	Kekri	Banas	Khari	MINOR	25.854802	75.106067	3.50	1,380.00	0.45	0.50	NA	38.06	1.65	21.05	21.00	21.05
348	Shesh Sagar Khewas	AJMER	Kekri	Banas	Khari	MINOR	25.849257	75.076221	3.65	2,580.00	0.62	0.62	NA	33.53	4.80	89.06	89.00	89.06
356	Shiv Sagar Uagamkhera	AJMER	Kekri	Banas	Khari	MINOR	25.933299	75.085280	3.20	1,871.00	0.16	0.17	NA	22.64	3.10	NA	22.70	22.67
359	Sitolav Sankeria	AJMER	Kekri	Banas	Khari	MINOR	25.822675	75.119563	3.81	1,650.00	0.42	0.42	NA	45.00	2.10	21.05	52.00	21.05
19	Bada Talab Dolatpura	AJMER	Masuda	Banas	Khari	MINOR	26.015353	74.604104	3.66	1,500.00	0.30	0.28	NA	136.20	3.00	54.00	52.60	42.91
36	Bada Talab Sathana	AJMER	Masuda	Banas	Khari	MINOR	25.977959	74.607174	4.72	2,640.00	1.19	1.19	NA	182.62	3.42	180.00	174.00	161.88
384	Bahadur Sagar Bahadurpura	AJMER	Masuda	Banas	Khari	Minor	25.996341	74.581880				0.20					36.40	
46	Bahadur Sagar Ramgarh	AJMER	Masuda	Banas	Khari	MINOR	25.989701	74.461482	3.70	1,500.00	0.34	0.40	NA	36.78	5.40	52.00	50.50	40.58
48	Baktawar Sagar Shergarh	AJMER	Masuda	Banas	Khari	MINOR	26.061555	74.542943	3.35	1,200.00	0.17	0.17	NA	155.80	1.50	44.00	40.00	16.19
51	Bala Sagar Dolatpura	AJMER	Masuda	Banas	Khari	MINOR	26.007656	74.580932	3.66	1,200.00	0.19	0.20	NA	34.21	1.20	36.00	33.60	27.12
73	Bhadoor Sagar Dolatpura	AJMER	Masuda	Banas	Khari	MINOR	26.011688	74.591226	3.96	1,500.00	0.20	0.20	NA	136.20	0.78	40.00	36.40	28.34
85	Bheru Sagar Bherukhera	AJMER	Masuda	Banas	Khari	MINOR	25.951336	74.522134	4.11	1,650.00	0.28	0.28	NA	37.37	5.40	52.00	51.00	40.48
87	Bheru Sagar Sathana	AJMER	Masuda	Banas	Khari	MINOR	25.968128	74.624185	4.11	1,470.00	0.31	0.42	NA	57.90	3.75	56.00	54.60	44.53
122	Devi Sagar Khempura	AJMER	Masuda	Banas	Khari	MINOR	26.079167	74.434167	5.79	435.00	0.17	0.20	NA	45.42	6.87	30.00	32.40	24.29
123	Devi Sagar Ramgarh	AJMER	Masuda	Banas	Khari	MINOR	25.966639	74.485058	5.03	645.00	0.37	0.37	NA	70.17	8.28	104.00	101.20	52.61
136	Fateh Sagar Marayala	AJMER	Masuda	Banas	Khari	MINOR	26.074806	74.594746	3.96	1,605.00	0.28	0.28	NA	61.78	2.10	52.00	50.60	40.48
146	Gopal Sagar Masuda	AJMER	Masuda	Banas	Khari	MINOR	26.085776	74.510108	3.66	1,371.00	0.17	0.17	NA	35.56	2.30	28.34	28.30	22.67
171	Jawallia Talab Shyamgarh	AJMER	Masuda	Banas	Khari	MINOR	26.095833	74.458333	2.74	84.00	0.28	0.28	NA	21.43	1.15	82.00	66.40	36.43
184	Kala Talab Shergarh	AJMER	Masuda	Banas	Khari	MINOR	26.075643	74.570500	3.50	2,400.00	0.24	0.23	NA	101.37	1.77	44.53	41.00	34.41
205	Khatolia Talab Shyamgarh	AJMER	Masuda	Banas	Khari	MINOR	26.107352	74.434498	5.18	450.00	0.27	0.30	NA	36.92	3.75	82.40	66.40	38.86
207	Kheda Talab Bhagwanpura	AJMER	Masuda	Banas	Khari	MINOR	26.073076	74.540703	3.35	1,650.00	0.17	0.17	NA	29.61	3.99	78.00	76.90	20.24
222	Lamba Talab Kalyanpura	AJMER	Masuda	Banas	Khari	MINOR	25.994661	74.541876	3.35	1,710.00	0.17	0.17	NA	65.15	NA	32.28	32.40	24.29
224	Lardi Irrigation Project	AJMER	Masuda	Banas	Khari	MINOR	26.027406	74.529370				4.46					1,156.10	
237	Man Ghati Kitap	AJMER	Masuda	Banas	Khari	MINOR	26.181353	74.528204	5.71	78.00	0.42	0.42	NA	37.09	3.17	32.00	30.40	24.29
253	Nand Sagar Nandwara	AJMER	Masuda	Banas	Khari	MINOR	26.035847	74.472097	3.81	945.00	1.26	1.25	NA	89.51	9.87	280.00	242.80	180.09
261	Naya Talab Bhiwana	AJMER	Masuda	Banas	Khari	MINOR	26.000483	74.404909	NA	797.00	32.96	0.20	NA	2,236.00	3.22	379.00	42.00	134.00
280	Neem Sagar Shivpuri	AJMER	Masuda	Banas	Khari	MINOR	26.011356	74.475510	3.81	1,950.00	0.71	0.71	NA	65.38	1.75	128.00	126.20	101.18
299	Pratap Sagar Kelu	AJMER	Masuda	Banas	Khari	MINOR	26.010449	74.518218	3.66	1,041.00	0.20	0.20	NA	18.06	1.17	38.00	36.40	28.33
305	Rai Sagar Shikhani	AJMER	Masuda	Banas	Khari	MINOR	25.952904	74.659751	3.96	3,780.00	0.23	0.23	NA	178.31	5.64	50.00	44.50	32.38
326	Ratan Sagar Masuda	AJMER	Masuda	Banas	Khari	MINOR	26.106240	74.494751	4.42	2,100.00	0.36	0.37	NA	85.40	3.36	64.00	61.00	51.41
342	Semati Tank Rewas	AJMER	Masuda	Banas	Khari	MINOR	25.979418	74.402503	5.79	1,320.00	1.61	0.62	NA	153.93	9.96	228.00	202.30	202.35
351	Shiv Sagar Lamba	AJMER	Masuda	Banas	Khari	MINOR	26.051410	74.593461	4.27	1,260.00	0.31	0.31	NA	66.57	3.78	60.00	57.00	44.53
355	Shiv Sagar Shivnagar	AJMER	Masuda	Banas	Khari	MINOR	25.947346	74.449278	3.96	1,200.00	0.16	0.20	NA	26.00	2.91	50.00	48.60	22.26
371	Swaroop Sagar Shivpuri	AJMER	Masuda	Banas	Khari	MINOR	26.001259	74.491961	3.35	1,380.00	0.34	0.34	NA	44.57	4.14	62.00	61.00	48.58
383	Vijay Sagar Shivpura	AJMER	Masuda	Banas	Khari	MINOR	26.040328	74.502835	4.72	1,149.00	0.40	0.40	NA	111.65	6.90	72.00	71.00	56.65
1048	Amar Sagar (nimbahe)	BHILWARA	Asind	Banas	Khari	MINOR	25.574124	74.474862				0.19					121.00	
1056	Arjun Sagar Asind	BHILWARA	Asind	Banas	Khari	MINOR	25.635520	74.388202	4.87	2,846.00	0.28	0.27	-	2,240.00	1.50		36.00	31.98
1058	Arjun Sagar Marawda	BHILWARA	Asind	Banas	Khari	MINOR	25.755828	74.336634				0.27					52.00	
1066	B.K.Sareri	BHILWARA	Asind	Banas	Khari	MINOR	25.633783	74.417961	8.50	2,609.00	2.66	2.60	-	9,240.00	5.37	587.00	526.00	298.00
1068	Bada Talab Barsani	BHILWARA	Asind	Banas	Khari	MINOR	25.759508	74.448311	4.27	1,902.00	1.70	1.70	-	300.00	3.00	-	310.00	194.00
1072	Bada Talab Mapliyas	BHILWARA	Asind	Banas	Khari	MINOR	25.671001	74.252440				1.19					191.00	
1079	Bajunda	BHILWARA	Asind	Banas	Khari	MINOR	25.775872	74.269386				0.18					32.00	
1084	Bani Sagar Jodhgarh	BHILWARA	Asind	Banas	Khari	MINOR	25.841798	74.416470				0.40					75.00	
1092	Bathera	BHILWARA	Asind	Banas	Khari	MINOR	25.732190	74.371922				0.24					80.00	
1105	Bhawani Sagar Kalias	BHILWARA	Asind	Banas	Khari	MINOR	25.687733	74.502485				0.99					187.00	
1468	Bhomlia	BHILWARA	Asind	Banas	Khari	Minor	25.660595	74.529097				0.50					136.44	
1115	Bhopal Sagar(Dhuwal)	BHILWARA	Asind	Banas	Khari	MINOR	25.511652	74.395677				0.51					162.00	
1117	Bijetha	BHILWARA	Asind	Banas	Khari	MINOR	25.599732	74.347478	7.53	1,340.00	1.59	0.70	0.10	154.00	3.60	387.00	202.00	136.00
1130	Chanarbhuj Sagar Lad	BHILWARA	Asind	Banas	Khari	MINOR	25.611686	74.352118				0.42					216.00	
1135	Chaterbhkuj (Sagar Rag	BHILWARA	Asind	Banas	Khari	MINOR	25.675049	74.291093	6.10	848.00	2.80	2.80	-	6,120.00	7.00	526.00	481.00	321.00
1147	Dalel Sagar Asind	BHILWARA	Asind	Banas	Khari	MINOR	25.677512	74.359498				0.66					130.00	
1164	Devi Sagar Devpura	BHILWARA	Asind	Banas	Khari	MINOR	25.688618	74.399755				0.42					85.00	
1166	Devi Sagar Nimbahera	BHILWARA	Asind	Banas	Khari	MINOR	25.580484	74.485144				0.38					73.00	
1170	Dhand Kalias	BHILWARA	Asind	Banas	Khari	MINOR	25.674576	74.502927				0.25					49.00	
1178	Dholaria Gageria	BHILWARA	Asind	Banas	Khari	MINOR	25.526757	74.521752	4.57	1,614.00	1.64	1.00	-	3,450.00	4.30	-	313.00	188.00
1184	Duleh Sagar Dhulepur	BHILWARA	Asind	Banas	Khari	MINOR	25.712792	74.339439				0.25					46.00	
1185	Dulesh Sagar Mal Ka	BHILWARA	Asind	Banas	Khari	MINOR	25.619086	74.440352				0.51					98.00	
1190	Fatehsagar Tiloli	BHILWARA	Asind	Banas	Khari	MINOR	25.605416	74.324077				0.25					49.00	
1191	Gadwai	BHILWARA	Asind	Banas	Khari	MINOR	25.754149	74.239938				0.17					47.00	

S. No.	Project Name	District	Block	Basin	Sub-basin	Class	Latitude (DD)	Longitude (DD)	Ht. above Lowest Foundation (m)	Length of Dam (m)	Gross Storage Capacity (Mm^3)	Live Storage Capacity (Mm^3)	Reservoir Area at FRL (km^2)	Design Spilway Capacity (cusecs)	Length of Canal System (km)	Command Area (ha)		
																GCA	CCA	ICA
1	2	3	4	5	6	7	9	10	11	12	13	14	15	16	17	18	19	20
1200	Girdhar Sagar Sapola	BHILWARA	Asind	Banas	Khari	MINOR	25.719308	74.348867				0.28					43.00	
1461	Girdharsagar Bherukhera	BHILWARA	Asind	Banas	Khari	Minor	25.737833	74.314334				0.23					64.78	
1201	Gjopal Sagar Asind	BHILWARA	Asind	Banas	Khari	MINOR	25.768537	74.231527				1.19					164.00	
1207	Govind Pura	BHILWARA	Asind	Banas	Khari	MINOR	25.930380	74.363496				0.10					45.00	
1212	Gul Khera	BHILWARA	Asind	Banas	Khari	MINOR	25.804655	74.367645				0.23					43.00	
1213	Gulab Sagar Lachuda	BHILWARA	Asind	Banas	Khari	MINOR	25.847384	74.382245				0.40					75.00	
1215	Gulab Sagar Rampura	BHILWARA	Asind	Banas	Khari	MINOR	25.936108	74.403571				0.30					75.00	
1485	Gulabsagar Khaso Ka Kheda	BHILWARA	Asind	Banas	Khari	Minor	25.850137	74.498597				0.17					32.39	
1221	Hatand	BHILWARA	Asind	Banas	Khari	MINOR	25.776504	74.379572				0.28					53.00	
1227	Hisniya	BHILWARA	Asind	Banas	Khari	MINOR	25.602105	74.453801				0.18					33.00	
1239	Jali	BHILWARA	Asind	Banas	Khari	MINOR	25.562105	74.365975				0.27					117.00	
1463	Jogidara	BHILWARA	Asind	Banas	Khari	Minor	25.888957	74.347046				0.27					52.00	
1250	Jogidhara Ojiyara	BHILWARA	Asind	Banas	Khari	MINOR	25.879363	74.348766				0.12					49.00	
1462	Kantalia	BHILWARA	Asind	Banas	Khari	Minor	25.750166	74.198426				0.91					189.47	
1266	Karjalla	BHILWARA	Asind	Banas	Khari	MINOR	25.612953	74.498371				0.42					80.00	
1277	Khatola	BHILWARA	Asind	Banas	Khari	MINOR	25.755260	74.382065				0.34					53.00	
1278	Khatola Bhojpura	BHILWARA	Asind	Banas	Khari	MINOR	25.785150	74.265352				0.51					70.00	
1283	Khuman Sagar Barasa	BHILWARA	Asind	Banas	Khari	MINOR	25.762484	74.467228				0.85					117.00	
1295	Lamba Patan	BHILWARA	Asind	Banas	Khari	MINOR	25.893184	74.376580				0.52					73.00	
1307	Madan Sagar maroo ka kheda	BHILWARA	Asind	Banas	Khari	MINOR	25.640890	74.396258				0.26					48.00	
1310	Mala Seri	BHILWARA	Asind	Banas	Khari	MINOR	25.714903	74.408504				0.24					45.00	
1316	Megh Sagar Motras	BHILWARA	Asind	Banas	Khari	MINOR	25.869129	74.404654				0.23					44.00	
1324	Motipur Ka Khera	BHILWARA	Asind	Banas	Khari	MINOR	25.648995	74.528346				0.34					66.00	
1325	Motipura	BHILWARA	Asind	Banas	Khari	MINOR	25.709754	74.475057				1.13					217.00	
1347	Nagdia Guda	BHILWARA	Asind	Banas	Khari	MINOR	25.664336	74.299018				0.50					113.00	
1329	Narayan Pura	BHILWARA	Asind	Banas	Khari	MINOR	25.672639	74.464583				0.41					77.00	
1335	Naval Sagar Kurcho	BHILWARA	Asind	Banas	Khari	MINOR	25.951959	74.376947				0.26					49.00	
1345	Nayla	BHILWARA	Asind	Banas	Khari	MINOR	25.832756	74.298588				0.23					43.00	
1357	Pairi	BHILWARA	Asind	Banas	Khari	MINOR	25.670986	74.432655				0.38					71.00	
1362	Patan (Deo Sagar)	BHILWARA	Asind	Banas	Khari	MINOR	25.914987	74.363914				6.85					1,745.00	
1366	Phool Sagar Barsani	BHILWARA	Asind	Banas	Khari	MINOR	25.784628	74.449413				0.42					81.00	
1381	Ram Sagar Ahiro Ka	BHILWARA	Asind	Banas	Khari	MINOR	25.627647	74.395599				0.16					28.00	
1413	Shambhu Garh Tarola	BHILWARA	Asind	Banas	Khari	MINOR	25.805221	74.413378				1.51					239.00	
1416	Shiv Sagar Akarsad	BHILWARA	Asind	Banas	Khari	MINOR	25.840005	74.392747				0.54					77.00	
1444	Tilolia Tiloli	BHILWARA	Asind	Banas	Khari	MINOR	25.593398	74.305640	9.14	675.00	2.04	2.04	-	4,301.00	1.00		388.00	233.00
1454	Unda Motras	BHILWARA	Asind	Banas	Khari	MINOR	25.885655	74.413715				0.62					101.00	
1455	Unda Patan	BHILWARA	Asind	Banas	Khari	MINOR	25.903924	74.376294				0.18					32.00	
1044	Akhev Raj	BHILWARA	Banera	Banas	Khari	MINOR	25.541540	74.672372				0.17					32.00	
1050	Amar Sagar Dudela	BHILWARA	Banera	Banas	Khari	MINOR	25.542618	74.629454				0.34					65.00	
1054	Anoop Sagar Raila	BHILWARA	Banera	Banas	Khari	MINOR	25.623179	74.620244				1.20					249.00	
1081	Balesaria	BHILWARA	Banera	Banas	Khari	MINOR	25.551902	74.612516				0.49					116.00	
1082	Balwant Sagar Kundia	BHILWARA	Banera	Banas	Khari	MINOR	25.678313	74.693171				0.34					68.00	
1097	Bhadolai Musa	BHILWARA	Banera	Banas	Khari	MINOR	25.632513	74.732465				0.54					102.00	
1107	Bheru Khera	BHILWARA	Banera	Banas	Khari	MINOR	25.534890	74.615975				0.25					49.00	
1133	Chater Sagar Kasosia	BHILWARA	Banera	Banas	Khari	MINOR	25.734651	74.695529				0.22					43.00	
1134	Chater Sager Vijaipur	BHILWARA	Banera	Banas	Khari	MINOR	25.719431	74.692504				0.42					82.00	
1136	Chatri Ka Talab Lamt	BHILWARA	Banera	Banas	Khari	MINOR	25.615009	74.607157				0.16					38.00	
1163	Dev Sagar Kundia	BHILWARA	Banera	Banas	Khari	MINOR	25.671887	74.674370				0.50					61.00	
1175	Dhiraj Sagar Kajlodia	BHILWARA	Banera	Banas	Khari	MINOR	25.487810	74.702187				0.14					43.00	
1203	Gora ka Khera	BHILWARA	Banera	Banas	Khari	MINOR	25.654878	74.649157				0.65					123.00	
1208	Govind Sagar Amarga	BHILWARA	Banera	Banas	Khari	MINOR	25.638910	74.749035				0.32					59.00	
1234	Jagat Sager Garta	BHILWARA	Banera	Banas	Khari	MINOR	25.698202	74.758123				0.34					48.00	
1240	Jalia	BHILWARA	Banera	Banas	Khari	MINOR	25.668146	74.710131	5.14	3,220.00	2.67	2.12	2.00	27,853.00	7.62	545.00	463.00	304.00
1243	Jawasia	BHILWARA	Banera	Banas	Khari	MINOR	25.596809	74.640088				2.00					267.00	
1473	Jhantal	BHILWARA	Banera	Banas	Khari	Minor	25.646011	74.747210				0.74					133.20	
1263	Kankolia	BHILWARA	Banera	Banas	Khari	MINOR	25.495416	74.708915				0.30					32.00	
1276	Khatola badi kundia	BHILWARA	Banera	Banas	Khari	MINOR	25.697530	74.666627	3.50	1,950.00	0.37	0.38	NA	35.66	2.89	46.96	72.00	46.96
1287	Kodlai	BHILWARA	Banera	Banas	Khari	MINOR	25.532707	74.704216				0.30					44.00	
1299	Lasodia Naya Talab	BHILWARA	Banera	Banas	Khari	MINOR	25.528231	74.722789				0.20					47.00	
1319	Moda Musha	BHILWARA	Banera	Banas	Khari	MINOR	25.640025	74.768993				0.44					85.00	
1328	Nahira	BHILWARA	Banera	Banas	Khari	MINOR	25.513727	74.670018				0.10					21.00	
1333	Natholai Raila	BHILWARA	Banera	Banas	Khari	MINOR	25.646711	74.611799				0.85					162.00	
1339	Naya Talab Badi Kundia	BHILWARA	Banera	Banas	Khari	MINOR	25.704222	74.674778				0.30					57.00	
1340	Naya Talab Lambia	BHILWARA	Banera	Banas	Khari	MINOR	25.590884	74.604650				0.30					38.00	
1341	Naya Talab Lambiya	BHILWARA	Banera	Banas	Khari	MINOR	25.606718	74.603792				0.20					38.00	
1342	Naya Talab Megras	BHILWARA	Banera	Banas	Khari	MINOR	25.605914	74.687226				0.62					124.00	
1350	Nimbahera Tank	BHILWARA	Banera	Banas	Khari	MINOR	25.652595	74.701437				0.30					62.00	

S. No.	Project Name	District	Block	Basin	Sub-basin	Class	Latitude (DD)	Longitude (DD)	Ht. above Lowest Foundation (m)	Length of Dam (m)	Gross Storage Capacity (Mm^3)	Live Storage Capacity (Mm^3)	Reservoir Area at FRL (km^2)	Design Spilway Capacity (cusecs)	Length of Canal System (km)	Command Area (ha)		
																GCA	CCA	ICA
1	2	3	4	5	6	7	9	10	11	12	13	14	15	16	17	18	19	20
1355	Pachgolai	BHILWARA	Banera	Banas	Khari	MINOR	25.652819	74.672260				0.65					117.00	
1367	Phoolia Khurd	BHILWARA	Banera	Banas	Khari	MINOR	25.603737	74.785963				0.22					121.00	
1387	Raxi	BHILWARA	Banera	Banas	Khari	MINOR	25.564311	74.700173				0.40					43.00	
1394	Salaria Kala	BHILWARA	Banera	Banas	Khari	MINOR	25.500982	74.670062				0.50					95.00	
1399	Sanganer	BHILWARA	Banera	Banas	Khari	MINOR	25.538694	74.655589				0.33					63.00	
1406	Sargola	BHILWARA	Banera	Banas	Khari	MINOR	25.674608	74.685409				1.02					198.00	
1431	Sawai Sagar Kasoria	BHILWARA	Banera	Banas	Khari	MINOR	25.722560	74.705054				0.25					35.00	
1419	Shiv Sagar Upreda	BHILWARA	Banera	Banas	Khari	MINOR	25.585753	74.743167				0.14					27.00	
1422	Somsiyas	BHILWARA	Banera	Banas	Khari	MINOR	25.609970	74.671247				0.70					124.00	
1427	Surajpura	BHILWARA	Banera	Banas	Khari	MINOR	25.565263	74.626129				0.20					27.00	
1448	Udai Sagar	BHILWARA	Banera	Banas	Khari	MINOR	25.519577	74.683389				1.44					275.00	
1449	Udai Sagar Mushi	BHILWARA	Banera	Banas	Khari	MINOR	25.607126	74.749270				0.90					254.00	
1042	Agucha	BHILWARA	Hurda	Banas	Khari	MINOR	25.829383	74.718618	5.80	6,016.00	4.53	4.53	-	13,400.00	4.36	1,113.00	890.00	518.00
1102	Barylias	BHILWARA	Hurda	Banas	Khari	MINOR	25.751909	74.487009				0.40					97.00	
1111	Bhojras	BHILWARA	Hurda	Banas	Khari	MINOR	25.780647	74.690853				1.08					205.00	
1154	Dantra	BHILWARA	Hurda	Banas	Khari	MINOR	25.821446	74.475809				0.93					178.00	
1209	Govind Sagar Kanwali	BHILWARA	Hurda	Banas	Khari	MINOR	25.743932	74.608912				0.40					75.00	
1219	Hajiyas	BHILWARA	Hurda	Banas	Khari	MINOR	25.794558	74.489836				0.27					49.00	
1228	Hiya Sagar Barathia	BHILWARA	Hurda	Banas	Khari	MINOR	25.778344	74.729984				0.65					124.00	
1230	Inani Khera	BHILWARA	Hurda	Banas	Khari	MINOR	25.860358	74.535081				0.60					81.00	
1237	Jalampura	BHILWARA	Hurda	Banas	Khari	MINOR	25.825256	74.526588				0.53					102.00	
1280	Khera Palola	BHILWARA	Hurda	Banas	Khari	MINOR	25.901324	74.736487				0.65					82.00	
1288	Kotri	BHILWARA	Hurda	Banas	Khari	MINOR	25.881743	74.735351				1.22					152.00	
1320	Modira	BHILWARA	Hurda	Banas	Khari	MINOR	25.818702	74.590414				1.05					200.00	
1361	Panuria Sodar	BHILWARA	Hurda	Banas	Khari	MINOR	25.750903	74.535963				0.37					96.00	
1368	Phutia bhagwan Pura	BHILWARA	Hurda	Banas	Khari	MINOR	25.792785	74.720041				0.99					188.00	
1438	Telia Sagar (Sodar)	BHILWARA	Hurda	Banas	Khari	MINOR	25.721888	74.539232				0.54					102.00	
1446	Tonkerwar	BHILWARA	Hurda	Banas	Khari	MINOR	25.784661	74.569816	5.33	2,373.00	3.62	3.06	-	12,190.00	12.00	1,923.00	850.00	415.00
1457	Unkhalia	BHILWARA	Hurda	Banas	Khari	MINOR	25.819975	74.554356				0.51					97.00	
1046	Almas	BHILWARA	Mandal	Banas	Khari	MINOR	25.568239	74.436090				0.23					41.00	
1057	Arjun Sagar Malas	BHILWARA	Mandal	Banas	Khari	MINOR	25.511197	74.324392				0.30					58.00	
1095	Bemali	BHILWARA	Mandal	Banas	Khari	MINOR	25.490769	74.275832				0.46					96.00	
1146	Dahi Matha	BHILWARA	Mandal	Banas	Khari	MINOR	25.530566	74.301556				0.40					36.00	
1151	Danta (Dhuwala)	BHILWARA	Mandal	Banas	Khari	MINOR	25.538867	74.489386				0.62					85.00	
1182	Dhunvala (mandal)	BHILWARA	Mandal	Banas	Khari	MINOR	25.527536	74.432537				0.82					146.00	
1460	Dhunwala Karea	BHILWARA	Mandal	Banas	Khari	Minor	25.588562	74.108506	NA	NA	NA	0.57	NA	NA	2.50	NA	107.69	NA
1192	Gajuna	BHILWARA	Mandal	Banas	Khari	MINOR	25.712210	74.149701				0.57					86.00	
1204	Gordhanpura	BHILWARA	Mandal	Banas	Khari	MINOR	25.601929	74.188131				0.40					81.00	
1224	Hathipura	BHILWARA	Mandal	Banas	Khari	MINOR	25.513329	74.369051				0.14					23.00	
1255	Kabradia	BHILWARA	Mandal	Banas	Khari	MINOR	25.590242	74.396648				0.24					75.00	
1271	Keria	BHILWARA	Mandal	Banas	Khari	MINOR	25.568519	74.410741				0.77					174.00	
1302	Laxmipura	BHILWARA	Mandal	Banas	Khari	MINOR	25.529010	74.472546				0.45					86.00	
1322	Mokhamsagar	BHILWARA	Mandal	Banas	Khari	MINOR	25.520312	74.304089				0.17					32.00	
1351	Niwla	BHILWARA	Mandal	Banas	Khari	MINOR	25.702825	74.090808				0.17					32.00	
1382	Ranjeet Sagar	BHILWARA	Mandal	Banas	Khari	MINOR	25.656239	74.136086				0.40					73.00	
1411	Sat Sagar Nimbhera	BHILWARA	Mandal	Banas	Khari	MINOR	25.606777	74.439117				0.30					57.00	
1420	Sidarias	BHILWARA	Mandal	Banas	Khari	MINOR	25.547405	74.482142				0.65					105.00	
1433	Swaroop Sagar	BHILWARA	Mandal	Banas	Khari	MINOR	25.528226	74.331323				0.85					162.00	
1442	Tikha	BHILWARA	Mandal	Banas	Khari	MINOR	25.635285	74.216884				0.21					53.00	
1049	Amar Sagar Dikola	BHILWARA	Shahpura	Banas	Khari	MINOR	25.546497	74.836977				0.18					121.00	
1051	Amartia	BHILWARA	Shahpura	Banas	Khari	MINOR	25.747969	74.875840				0.17					32.00	
1053	Amli Bareth	BHILWARA	Shahpura	Banas	Khari	MINOR	25.751168	74.998179				0.47					89.00	
1060	Armi	BHILWARA	Shahpura	Banas	Khari	MINOR	25.581487	74.933333				0.08					38.00	
1062	Arnia Rasa	BHILWARA	Shahpura	Banas	Khari	MINOR	25.565667	74.944111				0.28					59.00	
1067	Bachh Khera	BHILWARA	Shahpura	Banas	Khari	MINOR	25.711767	75.018066				0.23					43.00	
1069	Bada Talab Borda	BHILWARA	Shahpura	Banas	Khari	MINOR	25.643454	74.826798				0.28					53.00	
1071	Bada Talab Delas	BHILWARA	Shahpura	Banas	Khari	MINOR	25.716875	74.863573				0.25					48.00	
1074	Bada Talab Rooppura	BHILWARA	Shahpura	Banas	Khari	MINOR	25.682103	74.845130				0.48					92.00	
1075	Badsara	BHILWARA	Shahpura	Banas	Khari	MINOR	25.583268	74.881926				0.25					48.00	
1078	Bajrolia	BHILWARA	Shahpura	Banas	Khari	MINOR	25.551555	74.800317				1.10					162.00	
1096	Baragarh	BHILWARA	Shahpura	Banas	Khari	MINOR	25.622117	74.945492				0.16					32.00	
1090	Baseda	BHILWARA	Shahpura	Banas	Khari	MINOR	25.750677	75.034551				0.47					90.00	
1109	Bhim Sagar Dhibola	BHILWARA	Shahpura	Banas	Khari	MINOR	25.538933	74.827281				0.71					324.00	
1132	Chandra Sagar Doulat	BHILWARA	Shahpura	Banas	Khari	MINOR	25.600506	74.846421				0.82					157.00	
1138	Chhota Arwar	BHILWARA	Shahpura	Banas	Khari	MINOR	25.824579	74.798622				0.17					32.00	
1139	Chhoti Dholai Borda	BHILWARA	Shahpura	Banas	Khari	MINOR	25.643419	74.811987				0.26					61.00	
1141	Chodiwala Mindolia	BHILWARA	Shahpura	Banas	Khari	MINOR	25.539040	74.896023				0.27					52.00	

S. No.	Project Name	District	Block	Basin	Sub-basin	Class	Latitude (DD)	Longitude (DD)	Ht. above Lowest Foundation (m)	Length of Dam (m)	Gross Storage Capacity (Mm^3)	Live Storage Capacity (Mm^3)	Reservoir Area at FRL (km^2)	Design Spilway Capacity (cusecs)	Length of Canal System (km)	Command Area (ha)		
																GCA	CCA	ICA
1	2	3	4	5	6	7	9	10	11	12	13	14	15	16	17	18	19	20
1142	Choota Nahar Sagar	BHILWARA	Shahpura	Banas	Khari	MINOR	25.556042	74.861069				0.82					157.00	
1144	Chotisiya	BHILWARA	Shahpura	Banas	Khari	MINOR	25.627783	74.868197				1.04					175.00	
1149	Dand Talab Piplaj	BHILWARA	Shahpura	Banas	Khari	MINOR	25.736651	75.067124	3.65	3,300.00	0.36	0.35	NA	53.14	4.66	28.34	28.30	28.34
1157	Debla Kachara	BHILWARA	Shahpura	Banas	Khari	MINOR	25.598666	74.947679				0.17					64.00	
1469	Deori Nalla	BHILWARA	Shahpura	Banas	Khari	Minor	25.675551	74.793131				1.10					308.00	
1165	Devi Sagar Kanechan	BHILWARA	Shahpura	Banas	Khari	MINOR	25.738482	74.876518				0.79					149.00	
1168	Dhakeria	BHILWARA	Shahpura	Banas	Khari	MINOR	25.530641	74.822989				0.14					34.00	
1169	Dhand Bhachh Khera	BHILWARA	Shahpura	Banas	Khari	MINOR	25.725983	75.015122				0.20					27.00	
1173	Dhanop	BHILWARA	Shahpura	Banas	Khari	MINOR	25.866260	74.888450				0.23					43.00	
1174	Dharmau	BHILWARA	Shahpura	Banas	Khari	MINOR	25.573584	74.867358				0.25					47.00	
1180	Dhora	BHILWARA	Shahpura	Banas	Khari	MINOR	25.600982	74.910759				0.16					30.00	
1196	Ganeshpura(b)	BHILWARA	Shahpura	Banas	Khari	MINOR	25.747257	74.865692				0.24					49.00	
1205	Gerdiwala Sardarpura	BHILWARA	Shahpura	Banas	Khari	MINOR	25.747732	74.932035				0.11					22.00	
1217	Gundly	BHILWARA	Shahpura	Banas	Khari	MINOR	25.629039	74.922590				0.22					42.00	
1225	Heera Sagar	BHILWARA	Shahpura	Banas	Khari	MINOR	25.632023	74.900941				0.13					25.00	
1229	Hukampura	BHILWARA	Shahpura	Banas	Khari	MINOR	25.810727	74.905411				0.25					48.00	
1231	Itmaria	BHILWARA	Shahpura	Banas	Khari	MINOR	25.533164	74.781959				0.11					21.00	
1241	Jar Jhorla Kadera	BHILWARA	Shahpura	Banas	Khari	MINOR	25.814659	75.013880	3.35	1,950.00	0.45	0.17	NA	38.06	NA	22.28	22.30	22.26
1249	Jodh Sagar Ragurajpura	BHILWARA	Shahpura	Banas	Khari	MINOR	25.581021	74.870028				0.60					81.00	
1261	Kanechan Khurd	BHILWARA	Shahpura	Banas	Khari	MINOR	25.691237	74.847814				0.25					48.00	
1269	Kashipuria	BHILWARA	Shahpura	Banas	Khari	MINOR	25.752753	74.809849				0.08					16.00	
1272	Kerolai	BHILWARA	Shahpura	Banas	Khari	MINOR	25.504389	74.802832				0.26					42.00	
1284	Kishan Sager Dev Ji ka	BHILWARA	Shahpura	Banas	Khari	MINOR	25.608442	74.967667				0.14					27.00	
1301	Lasodia(b)	BHILWARA	Shahpura	Banas	Khari	MINOR	25.688841	75.065842				0.30					61.00	
1311	Malam Sagar Kanecha	BHILWARA	Shahpura	Banas	Khari	MINOR	25.730389	74.880174				0.40					77.00	
1344	Naya Talab Shahpura	BHILWARA	Shahpura	Banas	Khari	MINOR	25.645572	74.933242				0.08					19.00	
1349	Nimbahera	BHILWARA	Shahpura	Banas	Khari	MINOR	25.644839	74.845606				0.32					48.00	
1359	Panotia	BHILWARA	Shahpura	Banas	Khari	MINOR	25.813312	74.824034				0.23					43.00	
1363	Patel Ki Nadi	BHILWARA	Shahpura	Banas	Khari	MINOR	25.761671	74.865988				0.22					41.00	
1369	Pipola Dikola	BHILWARA	Shahpura	Banas	Khari	MINOR	25.549869	74.828021				0.17					33.00	
1378	Rahed	BHILWARA	Shahpura	Banas	Khari	MINOR	25.701387	74.963372				0.92					176.00	
1379	Raipur Tehnal	BHILWARA	Shahpura	Banas	Khari	MINOR	25.602869	74.823089				0.17					32.00	
1397	Samelia	BHILWARA	Shahpura	Banas	Khari	MINOR	25.665392	74.796377				0.51					79.00	
1400	Sangeria	BHILWARA	Shahpura	Banas	Khari	MINOR	25.846400	74.843776				0.62					118.00	
1424	Sopura	BHILWARA	Shahpura	Banas	Khari	MINOR	25.604917	74.872298				0.34					57.00	
1429	Surli	BHILWARA	Shahpura	Banas	Khari	MINOR	25.659332	74.930262				0.13					25.00	
1436	Taswaria	BHILWARA	Shahpura	Banas	Khari	MINOR	25.651354	75.069139				0.23					43.00	
1447	Topa mataji ka Khera	BHILWARA	Shahpura	Banas	Khari	MINOR	25.681963	74.950433				0.26					80.00	
1450	Udai Sagar Tehnal	BHILWARA	Shahpura	Banas	Khari	MINOR	25.670093	74.850270				0.25					44.00	
1171	Dhand Kunwar	BHILWARA	Suwana	Banas	Khari	MINOR	25.484025	74.780221				0.42					42.00	
1389	Richhda	BHILWARA	Suwana	Banas	Khari	MINOR	25.431670	74.748163				0.34					65.00	
2735	Ajit Garh Rapat	RAJSAMAND	Bhim	Banas	Khari	MINOR	25.766813	74.144762				0.26					37.18	
2736	Ajit Garh Tank	RAJSAMAND	Bhim	Banas	Khari	MINOR	25.785705	74.148821				0.28					71.00	
2738	Bada Talab	RAJSAMAND	Bhim	Banas	Khari	MINOR	25.724610	74.136098				0.09					12.87	Banas
2739	Baggar	RAJSAMAND	Bhim	Banas	Khari	MINOR	25.602772	73.900260				0.67					150.00	
2742	Bar Tank	RAJSAMAND	Bhim	Banas	Khari	MINOR	25.902918	74.302455				0.42					67.00	
2743	Barjal	RAJSAMAND	Bhim	Banas	Khari	MINOR	25.490774	73.860647				0.46					101.00	
2747	Bhim Rapat	RAJSAMAND	Bhim	Banas	Khari	MINOR	25.732075	74.094273				0.20					28.60	
2748	Bhim Tank	RAJSAMAND	Bhim	Banas	Khari	MINOR	25.740369	74.086673				2.16					425.00	
2749	Bhopalsagar	RAJSAMAND	Bhim	Banas	Khari	MINOR	25.726179	74.123952				2.65					506.00	
2751	Chapli	RAJSAMAND	Bhim	Banas	Khari	MINOR	25.467340	73.862525				0.53					158.00	
2756	Dabia	RAJSAMAND	Bhim	Banas	Khari	MINOR	25.943669	74.338033				0.51					101.00	
2757	Dadi Rapat	RAJSAMAND	Bhim	Banas	Khari	MINOR	25.660530	74.033410				0.32					192.00	
2758	Deheria	RAJSAMAND	Bhim	Banas	Khari	MINOR	25.746030	74.170755				0.10					14.30	
2760	Devi Sagar	RAJSAMAND	Bhim	Banas	Khari	MINOR	25.778447	74.109881				0.45					91.00	
2776	Kadia Deh	RAJSAMAND	Bhim	Banas	Khari	MINOR	25.732027	74.137488				1.30					189.00	
2779	Kakeria Rapat	RAJSAMAND	Bhim	Banas	Khari	MINOR	25.768969	74.164558				1.42					267.00	
2785	Khara Wala	RAJSAMAND	Bhim	Banas	Khari	MINOR	25.696611	74.060239				0.44					106.00	
2790	Kushal Pura	RAJSAMAND	Bhim	Banas	Khari	MINOR	25.670923	74.043314				0.24					49.00	
2791	Lakha Guda	RAJSAMAND	Bhim	Banas	Khari	MINOR	25.627819	73.931849				0.59					69.00	
2792	Lal pura	RAJSAMAND	Bhim	Banas	Khari	MINOR	25.786697	74.173723				0.31					61.00	
2794	Laxmi Sagar	RAJSAMAND	Bhim	Banas	Khari	MINOR	25.715778	74.062254				0.42					80.00	
2802	Miyala	RAJSAMAND	Bhim	Banas	Khari	MINOR	25.641323	73.955123				0.80					137.00	
2803	Moda kakar	RAJSAMAND	Bhim	Banas	Khari	MINOR	25.713390	74.080891				0.46					136.00	
2806	Nadi Nala	RAJSAMAND	Bhim	Banas	Khari	MINOR	25.664883	74.000568				1.10					137.00	
2807	Navlia pag	RAJSAMAND	Bhim	Banas	Khari	MINOR	25.455422	73.856737				0.14					26.00	
2810	Phool Sagar	RAJSAMAND	Bhim	Banas	Khari	MINOR	25.685123	74.066699				0.22					59.00	

S. No.	Project Name	District	Block	Basin	Sub-basin	Class	Latitude (DD)	Longitude (DD)	Ht. above Lowest Foundation (m)	Length of Dam (m)	Gross Storage Capacity (Mm^3)	Live Storage Capacity (Mm^3)	Reservoir Area at FRL (km^2)	Design Spilway Capacity (cusecs)	Length of Canal System (km)	Command Area (ha)		
																GCA	CCA	ICA
1	2	3	4	5	6	7	9	10	11	12	13	14	15	16	17	18	19	20
2811	Phutel	RAJSAMAND	Bhim	Banas	Khari	MINOR	25.718664	74.090118				0.22					69.00	
2812	Rajwa Rapat	RAJSAMAND	Bhim	Banas	Khari	MINOR	25.878269	74.234777				0.22					32.00	
2819	Sangawas	RAJSAMAND	Bhim	Banas	Khari	MINOR	25.599931	73.978846				0.80					149.00	
2823	Semlia (Samiche wala)	RAJSAMAND	Bhim	Banas	Khari	MINOR	25.742560	74.162118				0.04					5.72	
2824	Sopura Asan Ali	RAJSAMAND	Bhim	Banas	Khari	MINOR	25.901417	74.280369				0.18					89.00	
2828	Tejar Lai	RAJSAMAND	Bhim	Banas	Khari	MINOR	25.737686	74.145342				0.03					4.29	
2740	Baniahatri	RAJSAMAND	Deogarh	Banas	Khari	MINOR	25.581758	74.046745				0.26					58.00	
2765	Ghati	RAJSAMAND	Deogarh	Banas	Khari	MINOR	25.573364	73.987953				0.22					47.00	
2771	Heera ka Khera	RAJSAMAND	Deogarh	Banas	Khari	MINOR	25.510737	73.899192				0.17					30.00	
2780	Kala Bhala	RAJSAMAND	Deogarh	Banas	Khari	MINOR	25.618493	74.055368				4.05					609.00	
2787	Kundeli	RAJSAMAND	Deogarh	Banas	Khari	MINOR	25.512721	73.930540				5.49					1,079.00	
2798	Mansarowar	RAJSAMAND	Deogarh	Banas	Khari	MINOR	25.551915	73.930479				1.11					252.00	
2815	Rupa Rail	RAJSAMAND	Deogarh	Banas	Khari	MINOR	25.514189	73.951887				0.18					29.00	
2832	Sangawas	RAJSAMAND	Deogarh	Banas	Khari	Minor	25.584624	73.927872				0.80					149.00	
3014	AsolaoAsolaoAsolao	TONK	Deoli	Banas	Khari	MINOR	25.930523	75.283294	3.96	1,472.00	0.28	0.28	0.07	950.00	Small W.Course	80.97	51.00	36.43
3081	Kalyan Sagar	TONK	Deoli	Banas	Khari	MINOR	25.928839	75.264421	3.96	1,760.00	0.37	0.37	0.09	1,386.00	3.06	151.82	91.00	60.72
3100	Man Sagar Arniya	TONK	Deoli	Banas	Khari	MINOR	25.901623	75.256216	3.80	1.83	1.64	1.64	8.28	25.00	3.69	587.00	463.00	234.82
3120	Panduria	TONK	Deoli	Banas	Khari	MINOR	25.887774	75.265343	3.28	914.00	0.14	0.15	0.09	514.00	0.61	68.82	20.20	20.24
	Sub Basin Total										**121.58**	**212.87**				**19,033.60**	**42,221.33**	**11,121.94**
1080	Baldeo Sagar Kalsas	BHILWARA	Banera	Banas	Kothari	MINOR	25.403476	74.727404				0.66					125.00	
1094	Beedwara Mindolia	BHILWARA	Banera	Banas	Kothari	MINOR	25.537311	74.569672				0.31					45.00	
1129	Chamanpura	BHILWARA	Banera	Banas	Kothari	MINOR	25.447232	74.625291				0.23					43.00	
1257	Kakrolia	BHILWARA	Kotri	Banas	Kothari	MINOR	25.343678	74.860157				0.20					46.00	
1285	Kishangarh	BHILWARA	Kotri	Banas	Kothari	MINOR	25.334164	74.974075				0.84					129.00	
1298	Lasodia (e)	BHILWARA	Kotri	Banas	Kothari	MINOR	25.352985	74.821098				0.22					33.00	
1376	Raghunath Pura	BHILWARA	Kotri	Banas	Kothari	MINOR	25.333746	74.887050				0.23					41.00	
1388	Redwas	BHILWARA	Kotri	Banas	Kothari	MINOR	25.341709	74.916184				0.42					81.00	
1466	Amargarh	BHILWARA	Mandal	Banas	Kothari	Minor	25.344720	74.456142				1.13					159.11	
1093	Bavias	BHILWARA	Mandal	Banas	Kothari	MINOR	25.360767	74.334574				0.45					87.00	
1086	Bawari	BHILWARA	Mandal	Banas	Kothari	MINOR	25.456744	74.490835				0.23					43.00	
1098	Bhadu Dhandh	BHILWARA	Mandal	Banas	Kothari	MINOR	25.430221	74.488521				0.65					43.00	
1099	Bhadu Naya (Mandal)	BHILWARA	Mandal	Banas	Kothari	MINOR	25.421401	74.498205				0.62					119.00	
1106	Bheru Khera	BHILWARA	Mandal	Banas	Kothari	MINOR	25.429875	74.464592				0.25					49.00	
1108	Bhilri	BHILWARA	Mandal	Banas	Kothari	MINOR	25.420644	74.344574				0.62					118.00	
1128	Chakned	BHILWARA	Mandal	Banas	Kothari	MINOR	25.450902	74.400088				0.45					98.00	
1140	Chileshwar	BHILWARA	Mandal	Banas	Kothari	MINOR	25.444293	74.499135				0.52					113.00	
1152	Danta Luharia	BHILWARA	Mandal	Banas	Kothari	MINOR	25.494812	74.531085				0.45					86.00	
1156	Daulatpura	BHILWARA	Mandal	Banas	Kothari	MINOR	25.418814	74.409489				0.38					77.00	
1158	Deelel Sagar	BHILWARA	Mandal	Banas	Kothari	MINOR	25.518546	74.220343				0.91					115.00	
1183	Dudela	BHILWARA	Mandal	Banas	Kothari	MINOR	25.540078	74.215283				0.34					89.00	
1198	Gangdeh (Mandal)	BHILWARA	Mandal	Banas	Kothari	MINOR	25.338366	74.371303				1.05					251.00	
1472	Godas Lift	BHILWARA	Mandal	Banas	Kothari	Minor	25.383495	74.471275				0.76					109.00	
1202	Gopalsagar (Kerara)	BHILWARA	Mandal	Banas	Kothari	MINOR	25.515973	74.205301				0.45					73.00	
1206	Gorkhiya	BHILWARA	Mandal	Banas	Kothari	MINOR	25.534655	74.107172				0.78					149.00	
1214	Gulab Sagar Laduwas	BHILWARA	Mandal	Banas	Kothari	MINOR	25.473212	74.336661				0.45					86.00	
1244	Jet Sagar Chandas	BHILWARA	Mandal	Banas	Kothari	MINOR	25.423879	74.322720				0.48					91.00	
1251	Jorawarpura	BHILWARA	Mandal	Banas	Kothari	MINOR	25.409055	74.421886				0.45					81.00	
1260	Kan Sagar	BHILWARA	Mandal	Banas	Kothari	MINOR	25.482403	74.430978				0.99					181.00	
1267	Kamipura	BHILWARA	Mandal	Banas	Kothari	MINOR	25.324749	74.383941				0.65					123.00	
1273	Kesar Sagar Chandras	BHILWARA	Mandal	Banas	Kothari	MINOR	25.464966	74.454172				0.57					116.00	
1286	Kishanwato Ki kheri	BHILWARA	Mandal	Banas	Kothari	MINOR	25.471933	74.603947				0.15					28.00	
1296	Lamxni Sagar I	BHILWARA	Mandal	Banas	Kothari	MINOR	25.475347	74.352131				0.42					82.00	
1300	Lasodia(a)	BHILWARA	Mandal	Banas	Kothari	MINOR	25.354922	74.434155				0.70					134.00	
1303	Leswa (Mewla)	BHILWARA	Mandal	Banas	Kothari	MINOR	25.412516	74.382469				0.65					124.00	
1304	Leswa (Naya)	BHILWARA	Mandal	Banas	Kothari	MINOR	25.377977	74.424696				0.51					97.00	
1318	Meja (Small)	BHILWARA	Mandal	Banas	Kothari	MINOR	25.409296	74.549654				0.67					204.00	
1336	Navalpura Mandal	BHILWARA	Mandal	Banas	Kothari	MINOR	25.394296	74.393579				3.96					755.00	
1346	Neem ka Khera	BHILWARA	Mandal	Banas	Kothari	MINOR	25.526589	74.568915				0.59					87.00	
1372	Pithas	BHILWARA	Mandal	Banas	Kothari	MINOR	25.372377	74.496392				0.40					87.00	
1385	Ratan Sagar	BHILWARA	Mandal	Banas	Kothari	MINOR	25.472892	74.384371				0.41					77.00	
1392	Sabalpura	BHILWARA	Mandal	Banas	Kothari	MINOR	25.479565	74.500489				0.10					11.00	
1428	Suras	BHILWARA	Mandal	Banas	Kothari	MINOR	25.395274	74.339102				0.23					43.00	
1434	Tavunka	BHILWARA	Mandal	Banas	Kothari	MINOR	25.308474	74.401556				0.45					86.00	
1059	Arjungarh	BHILWARA	Raipur	Banas	Kothari	MINOR	25.477727	74.209311				0.40					129.00	
1063	Atawara	BHILWARA	Raipur	Banas	Kothari	MINOR	25.351001	74.180090	10.36	2,671.00	5.24	5.09	-	14,200.00	6.45	-	1,174.00	583.00
1103	Bharu Khera	BHILWARA	Raipur	Banas	Kothari	MINOR	25.350000	74.033333				0.79					123.00	

S. No.	Project Name	District	Block	Basin	Sub-basin	Class	Latitude (DD)	Longitude (DD)	Ht. above Lowest Foundation (m)	Length of Dam (m)	Gross Storage Capacity (Mm^3)	Live Storage Capacity (Mm^3)	Reservoir Area at FRL (km^2)	Design Spilway Capacity (cusecs)	Length of Canal System (km)	Command Area (ha)		
																GCA	CCA	ICA
1	2	3	4	5	6	7	9	10	11	12	13	14	15	16	17	18	19	20
1137	Chapria	BHILWARA	Raipur	Banas	Kothari	MINOR	25.410991	74.198987				0.28					89.00	
1161	Deori (Raipur)	BHILWARA	Raipur	Banas	Kothari	MINOR	25.279097	74.144044	4.27	2,132.00	4.30	3.65	-	9,400.00	15.60	-	696.00	418.00
1194	Galyawadi	BHILWARA	Raipur	Banas	Kothari	MINOR	25.349790	74.147185				0.42					73.00	
1236	Jagpura	BHILWARA	Raipur	Banas	Kothari	MINOR	25.459688	74.181052				0.54					115.00	
1246	Jhadol Raipur	BHILWARA	Raipur	Banas	Kothari	MINOR	25.405574	74.163647	6.40	1,382.00	3.00	2.94	-	-	14.55	-	1,134.00	337.00
1254	Kaberda	BHILWARA	Raipur	Banas	Kothari	MINOR	25.410009	74.175183				0.57					108.00	
1259	Kalal Kheri	BHILWARA	Raipur	Banas	Kothari	MINOR	25.449212	74.146440				0.14					29.00	
1270	Kemunia	BHILWARA	Raipur	Banas	Kothari	MINOR	25.386280	74.155919				1.54					254.00	
1279	Khemana	BHILWARA	Raipur	Banas	Kothari	MINOR	25.356261	74.156909				0.61					84.00	
1291	Kurjia	BHILWARA	Raipur	Banas	Kothari	MINOR	25.393366	74.182815				0.60					115.00	
1297	Larki	BHILWARA	Raipur	Banas	Kothari	MINOR	25.405469	74.090310	12.28	581.00	3.79	2.77	-	27,150.00	22.20	1,851.00	961.00	317.00
1321	Mokhampura	BHILWARA	Raipur	Banas	Kothari	MINOR	25.426428	74.226557				0.28					53.00	
1331	Nathdias	BHILWARA	Raipur	Banas	Kothari	MINOR	25.431777	74.239970				0.38					72.00	
1371	Pithalpura	BHILWARA	Raipur	Banas	Kothari	MINOR	25.446389	74.209075				1.04					158.00	
1377	Ragtia Nansa	BHILWARA	Raipur	Banas	Kothari	MINOR	25.359327	74.205624				0.34					51.00	
1404	Sardarsagar Nansa	BHILWARA	Raipur	Banas	Kothari	MINOR	25.353338	74.202251				0.32					45.00	
1407	Sargram Sagar Barona	BHILWARA	Raipur	Banas	Kothari	MINOR	25.422167	74.176353				1.10					207.00	
1440	Thala	BHILWARA	Raipur	Banas	Kothari	MINOR	25.457582	74.193686				1.50					216.00	
1452	Umed Sagar Koshithal	BHILWARA	Raipur	Banas	Kothari	MINOR	25.300211	74.151174				0.28					53.00	
1458	Useria	BHILWARA	Raipur	Banas	Kothari	MINOR	25.417687	74.199458				0.23					81.00	
1052	Amli	BHILWARA	Sahara	Banas	Kothari	MINOR	25.289793	74.312995				0.70					100.00	
1127	Boriapura	BHILWARA	Sahara	Banas	Kothari	MINOR	25.319549	74.316600				0.95					171.00	
1343	Naya Talab Nansa	BHILWARA	Sahara	Banas	Kothari	MINOR	25.346055	74.207030				0.40					61.00	
1356	Padam Sagar Koshitha	BHILWARA	Sahara	Banas	Kothari	MINOR	25.313666	74.174465				0.16					24.00	
1451	Ulalai	BHILWARA	Sahara	Banas	Kothari	MINOR	25.262699	74.181226				0.58					110.00	
1155	Dariba	BHILWARA	Suwana	Banas	Kothari	MINOR	25.334740	74.518972				1.00					188.00	
1216	Gundli	BHILWARA	Suwana	Banas	Kothari	MINOR	25.325291	74.461225				0.08					16.00	
1220	Haler	BHILWARA	Suwana	Banas	Kothari	MINOR	25.321509	74.685474				0.52					99.00	
1360	Pansal	BHILWARA	Suwana	Banas	Kothari	MINOR	25.359781	74.581415				1.04					199.00	
1398	Samodi	BHILWARA	Suwana	Banas	Kothari	MINOR	25.345541	74.553055				0.20					38.00	
2829	Tikkar	RAJSAMAND	Amet	Banas	Kothari	MINOR	25.398334	73.907108				1.12					200.00	
2831	Bhutala	RAJSAMAND	Deogarh	Banas	Kothari	Minor	25.528944	74.005913				0.11					22.00	
2762	Dhedbara ka naka	RAJSAMAND	Deogarh	Banas	Kothari	MINOR	25.392591	73.830075				0.54					113.00	
2770	Gunia	RAJSAMAND	Deogarh	Banas	Kothari	MINOR	25.379141	73.881636				1.30					248.00	
2774	Jiran	RAJSAMAND	Deogarh	Banas	Kothari	MINOR	25.421061	73.909527				0.27					54.00	
2781	Kanvera	RAJSAMAND	Deogarh	Banas	Kothari	MINOR	25.461167	73.999021				0.25					43.00	
2800	Methajhara	RAJSAMAND	Deogarh	Banas	Kothari	MINOR	25.479453	73.959189				0.32					54.00	
2834	Modadeha	RAJSAMAND	Deogarh	Banas	Kothari	Minor	25.364426	73.970891				0.41					98.00	
2804	Mokhunda	RAJSAMAND	Deogarh	Banas	Kothari	MINOR	25.310715	74.082115				0.77					147.00	
2835	Mosam Sagar	RAJSAMAND	Deogarh	Banas	Kothari	Minor	25.526388	74.007340				0.35					63.00	
2808	Neemjhar	RAJSAMAND	Deogarh	Banas	Kothari	MINOR	25.515584	74.045500				2.44					599.00	
	Sub Basin Total										**16.33**	**65.30**				**1,851.00**	**13,481.11**	**1,655.00**
80	Bhawani Sagar Ketsura	AJMER	Arain	Banas	Mashi	MINOR	26.497766	74.989068	4.87	1,870.00	1.13	1.13	NA	92.82	NA	549.58	270.30	161.98
126	Dhan Sagar Dadiya	AJMER	Arain	Banas	Mashi	MINOR	26.445142	74.990427	4.51	1,680.00	1.33	1.33	NA	111.04	NA	425.74	216.90	189.80
141	Ganesh Sagar Katsura	AJMER	Arain	Banas	Mashi	MINOR	26.472006	74.983284	4.78	1,950.00	0.65	0.65	NA	96.02	NA	247.27	126.00	97.13
169	Jawahar Sagar Sirons	AJMER	Arain	Banas	Mashi	MINOR	26.469192	75.082978	NA	NA	1.58	1.58	NA	141.01	3.20	691.22	345.60	226.62
211	Kishan sagar Gagunda	AJMER	Arain	Banas	Mashi	MINOR	26.508333	75.116667	NA	NA	1.78	1.78	NA	150.56	4.30	768.92	384.50	258.19
214	Kodia Sagar Arain	AJMER	Arain	Banas	Mashi	MINOR	26.456578	75.013439	NA	NA	2.83	2.83	NA	195.52	42.07	567.57	509.90	344.00
363	Sukh Sagar Sirons	AJMER	Arain	Banas	Mashi	MINOR	26.490579	75.093029	NA	NA	1.42	1.42	NA	121.29	12.80	660.04	303.50	204.37
370	Surkheli Sagar	AJMER	Arain	Banas	Mashi	MINOR	26.466667	75.033333	NA	NA	1.43	1.40	NA	121.29	41.20	738.32	69.10	611.08
379	Vijai Sagar Lamba	AJMER	Arain	Banas	Mashi	MINOR	26.486104	74.996016	NA	NA	1.58	1.58	NA	121.29	3.40	725.21	362.60	266.62
380	Vijay Sagar Akodia	AJMER	Arain	Banas	Mashi	MINOR	26.376671	75.008201	NA	NA	1.56	1.56	NA	133.26	3.50	712.26	356.10	200.00
78	Bharu Sagar Balupura	AJMER	Kishangarh	Banas	Mashi	MINOR	26.482585	74.926378				0.37					155.40	
99	Chandolai Tank Bandarsind	AJMER	Kishangarh	Banas	Mashi	MINOR	26.580532	75.035583				0.71					176.40	
112	Daidika nada barna	AJMER	Kishangarh	Banas	Mashi	MINOR	26.510162	74.921820				0.17					40.50	
129	Dholi Ghata Bandarsindari	AJMER	Kishangarh	Banas	Mashi	MINOR	26.620692	75.009223				0.47					100.00	
149	Gordhan Sagar Barna	AJMER	Kishangarh	Banas	Mashi	MINOR	26.504307	74.886509	NA	830.00	21.37	0.59	NA	2,276.00	1.28	274.00	137.20	87.00
155	Hanuman Sagar Barna	AJMER	Kishangarh	Banas	Mashi	MINOR	26.501086	74.922094	NA	760.00	28.80	0.80	NA	1,480.00	2.28	596.00	299.50	210.00
163	Jai Sagar Didwara	AJMER	Kishangarh	Banas	Mashi	MINOR	26.571111	74.985000				0.76					213.60	
168	Jathumb Kishangarh	AJMER	Kishangarh	Banas	Mashi	MINOR	26.583414	74.858456	NA	530.00	5.71	0.16	NA	775.00	0.83	130.00	64.80	23.00
177	Jodhala Sagar Khacharia	AJMER	Kishangarh	Banas	Mashi	MINOR	26.522368	74.878615	NA	1,780.00	13.75	0.40	NA	1,118.00	2.57	45.00	44.50	28.00
178	JuliSagar Mundatu	AJMER	Kishangarh	Banas	Mashi	MINOR	26.656356	75.033791				0.25					65.00	
196	Karni sagar Rari	AJMER	Kishangarh	Banas	Mashi	MINOR	26.516357	74.912130	NA	840.00	9.00	0.25	NA	1,056.00	4.34	121.00	60.70	36.00
204	Khatolai Tank Bandersindri	AJMER	Kishangarh	Banas	Mashi	MINOR	26.589438	75.053231	NA	1,120.00	21.15	0.59	NA	2,759.00	1.28	258.00	135.90	81.00
221	Lamba sagar Sergaon	AJMER	Kishangarh	Banas	Mashi	MINOR	26.568740	74.927568	NA	1,670.00	26.44	0.80	NA	2,334.00	1.82	226.00	171.60	117.00
233	Madan Sagar Deedwara	AJMER	Kishangarh	Banas	Mashi	MINOR	26.552775	74.967302	NA	1,440.00	1.67	1.67	NA	4,108.00	10.02	726.00	382.00	178.00
260	Naya Talab Barna	AJMER	Kishangarh	Banas	Mashi	MINOR	26.507775	74.904207	NA	797.00	32.96	0.93	NA	2,236.00	3.22	379.00	189.00	134.00

S. No.	Project Name	District	Block	Basin	Sub-basin	Class	Latitude (DD)	Longitude (DD)	Ht. above Lowest Foundation (m)	Length of Dam (m)	Gross Storage Capacity (Mm^3)	Live Storage Capacity (Mm^3)	Reservoir Area at FRL (km^2)	Design Spilway Capacity (cusecs)	Length of Canal System (km)	Command Area (ha)		
																GCA	CCA	ICA
1	2	3	4	5	6	7	9	10	11	12	13	14	15	16	17	18	19	20
267	Naya talab kacharia	AJMER	Kishangarh	Banas	Mashi	MINOR	26.538530	74.896018	NA	610.00	6.00	0.17	NA	NA	1.51	24.00	24.30	20.00
287	Parbat Sagar Sergaon	AJMER	Kishangarh	Banas	Mashi	MINOR	26.550000	74.916667	NA	1,700.00	9.57	0.25	NA	1,388.00	2.28	123.00	64.80	40.00
313	Ram Sagar Rampura	AJMER	Kishangarh	Banas	Mashi	MINOR	26.709046	74.949488	NA	1,860.00	35.64	0.71	NA	2,334.00	4.66	314.00	165.10	77.00
315	Ram samand Nayagaon	AJMER	Kishangarh	Banas	Mashi	MINOR	26.577394	74.875735	NA	914.00	1.16	1.16	NA	2,758.00	1.99	946.00	472.70	167.00
316	Ram Sarowar Bandarsindari	AJMER	Kishangarh	Banas	Mashi	MINOR	26.600013	75.016043	NA	1,370.00	20.43	0.56	NA	3,924.00	4.02	252.00	132.70	49.00
373	Tilonia Tank	AJMER	Kishangarh	Banas	Mashi	MINOR	26.661111	74.930000				0.48					101.10	
376	Ummed Sagar Noriya	AJMER	Kishangarh	Banas	Mashi	MINOR	26.589012	75.007858	NA	790.00	28.77	0.82	NA	2,334.00	2.41	357.00	187.70	113.00
1949	Bhojyada	JAIPUR	Chaksu	Banas	Mashi	Minor	26.617510	75.810891				1.50					120.00	
1860	Bhoyara	JAIPUR	Chaksu	Banas	Mashi	MINOR	26.618303	75.810886				1.56					199.80	
1897	Kadera	JAIPUR	Chaksu	Banas	Mashi	MINOR	26.605761	75.837975				0.42					160.30	
1910	Madho Singh Pura	JAIPUR	Chaksu	Banas	Mashi	MINOR	26.545151	75.893410				0.82					143.70	
1927	Pipla	JAIPUR	Chaksu	Banas	Mashi	MINOR	26.587088	75.807233				1.90					385.00	
1845	Agar Sagar	JAIPUR	Dudu	Banas	Mashi	MINOR	26.575398	75.298183				0.34					97.50	
1846	Akoda	JAIPUR	Dudu	Banas	Mashi	MINOR	26.817705	75.290107				0.60					160.00	
1847	Bad Solinkia	JAIPUR	Dudu	Banas	Mashi	MINOR	26.732519	75.448059				0.34					94.00	
1850	Bandolao	JAIPUR	Dudu	Banas	Mashi	MINOR	26.816171	75.233318			1.41	1.42		NA			374.00	200.00
1852	Bankia Sagar	JAIPUR	Dudu	Banas	Mashi	MINOR	26.569351	75.368198				0.62					71.00	
1853	Beni Kheda Rehlana	JAIPUR	Dudu	Banas	Mashi	MINOR	26.575044	75.139074				0.28					32.00	
1863	Bichun	JAIPUR	Dudu	Banas	Mashi	MINOR	26.859940	75.373657				0.37					76.00	
1865	Bohra Ka Dund	JAIPUR	Dudu	Banas	Mashi	MINOR	26.627373	75.340674				0.30					58.70	
1867	Chhar Bund	JAIPUR	Dudu	Banas	Mashi	MINOR	26.727347	74.990291				0.34					101.20	
1871	Chuliawas	JAIPUR	Dudu	Banas	Mashi	MINOR	26.778992	75.233790				0.62					189.80	
1875	Dhabolav Narena	JAIPUR	Dudu	Banas	Mashi	MINOR	26.797133	75.217502				2.21					603.00	
1876	Dhamana	JAIPUR	Dudu	Banas	Mashi	MINOR	26.627685	75.378008				0.20					64.75	
1877	Dhobalab Jhag	JAIPUR	Dudu	Banas	Mashi	MINOR	26.773241	75.171646				0.37					59.90	
1880	Doriya	JAIPUR	Dudu	Banas	Mashi	MINOR	26.540978	75.241031				1.20					228.00	
1882	Ganga Sagar	JAIPUR	Dudu	Banas	Mashi	MINOR	26.705988	75.208200				1.00					357.00	
1883	Gehlota	JAIPUR	Dudu	Banas	Mashi	MINOR	26.699475	74.977637				0.54					44.80	
1888	Gzaizy	JAIPUR	Dudu	Banas	Mashi	MINOR	26.666667	75.188889				0.40					38.20	
1890	Hanuman Sagar Gagadu	JAIPUR	Dudu	Banas	Mashi	MINOR	26.517185	75.140320				0.76					80.00	
1892	Harsoli	JAIPUR	Dudu	Banas	Mashi	MINOR	26.617044	75.148943				0.37					49.00	
1903	Kharbon Ka Bas	JAIPUR	Dudu	Banas	Mashi	MINOR	26.757473	75.359213				0.46					66.00	
1905	Kodiya Sagar	JAIPUR	Dudu	Banas	Mashi	MINOR	26.580842	75.357946				0.54					121.40	
1908	Ladera	JAIPUR	Dudu	Banas	Mashi	MINOR	26.679167	75.056667				1.30					204.40	
1913	Manpura	JAIPUR	Dudu	Banas	Mashi	MINOR	26.714232	75.394494				0.28					124.70	
1917	Naya Sagar Mokhampura	JAIPUR	Dudu	Banas	Mashi	MINOR	26.750948	75.280410				0.40					50.00	
1918	Naya Sagar Mozmabad	JAIPUR	Dudu	Banas	Mashi	MINOR	26.703642	75.340973			2.60	2.60					560.00	459.00
1849	Bala Sagar Sultania	JAIPUR	Phagi	Banas	Mashi	MINOR	26.631044	75.539124				0.51					115.00	
1861	Bhudiya Sagar	JAIPUR	Phagi	Banas	Mashi	MINOR	26.594418	75.553841				0.17					60.70	
1862	Bhujyali	JAIPUR	Phagi	Banas	Mashi	MINOR	26.551440	75.505722				0.93					32.40	
1869	Choru Sagar Choru	JAIPUR	Phagi	Banas	Mashi	MINOR	26.546026	75.377593				1.08					396.60	
1953	Dantudi	JAIPUR	Phagi	Banas	Mashi	Minor	26.600422	75.635574				0.60					79.00	
1878	Dholai	JAIPUR	Phagi	Banas	Mashi	MINOR	26.584703	75.510271	4.57	1,334.00	0.14	0.23	0.03	561.00	Small W.Course	50.60	16.00	20.24
1884	Ghatyali	JAIPUR	Phagi	Banas	Mashi	MINOR	26.509161	75.366564				0.40					192.20	
1885	Gokulpura	JAIPUR	Phagi	Banas	Mashi	MINOR	26.473594	75.597184				0.85					122.00	
1898	Kala Talab	JAIPUR	Phagi	Banas	Mashi	MINOR	26.674433	75.627378				0.88					200.70	
1899	Kanolav	JAIPUR	Phagi	Banas	Mashi	MINOR	26.553280	75.546436				0.40					100.40	
1901	Kerya Sagar	JAIPUR	Phagi	Banas	Mashi	MINOR	26.523098	75.538660				0.45					64.80	
1902	Khajri	JAIPUR	Phagi	Banas	Mashi	MINOR	26.544674	75.773563				2.80					454.10	
1951	Kishanpura	JAIPUR	Phagi	Banas	Mashi	Minor	26.707853	75.630585				0.17					40.50	
1914	Moti Sagar	JAIPUR	Phagi	Banas	Mashi	MINOR	26.558662	75.408388				0.20					28.30	
1915	Nain Siega	JAIPUR	Phagi	Banas	Mashi	MINOR	26.517587	75.484677				0.62					141.60	
1916	Naya Sagar Avandia	JAIPUR	Phagi	Banas	Mashi	MINOR	26.651802	75.508392				0.51					151.40	
1919	Naya Talab Jhog	JAIPUR	Phagi	Banas	Mashi	MINOR	26.709119	75.529669				0.48					104.00	
1928	Pratap Sagar Bhojpura	JAIPUR	Phagi	Banas	Mashi	MINOR	26.603236	75.642928				0.71					162.00	
1933	Ram Sagar Choru	JAIPUR	Phagi	Banas	Mashi	MINOR	26.515572	75.388431				0.31					163.90	
1934	Ram Sagar Madhopura	JAIPUR	Phagi	Banas	Mashi	MINOR	26.532256	75.652219				0.51					113.70	
1936	Ram Sagar Phagi	JAIPUR	Phagi	Banas	Mashi	MINOR	26.577169	75.547489				0.59					93.90	
1940	Rani Sagar Lasadia	JAIPUR	Phagi	Banas	Mashi	MINOR	26.545930	75.467880				0.34					101.60	
1948	Tile Lao	JAIPUR	Phagi	Banas	Mashi	MINOR	26.607935	75.508973				1.22					271.10	
1868	Chirota	JAIPUR	Sanganer	Banas	Mashi	MINOR	26.806124	75.636972				0.26					57.00	
1935	Ram Sagar Nevta	JAIPUR	Sanganer	Banas	Mashi	MINOR	26.803759	75.681507				6.50					1,533.00	
1895	Jamdeye	JAIPUR	Shahpura	Banas	Mashi	MINOR	27.234559	75.853581	12.00		2.74	2.46		103.48		685.94	587.00	352.00
3051	Dhand Sagar	TONK	Malpura	Banas	Mashi	MINOR	26.475751	75.213025			0.25	0.25					51.00	
3054	Dheer Sagar Lawa	TONK	Malpura	Banas	Mashi	MINOR	26.379265	75.539494	3.96	1,280.00	0.34	0.34	0.09	2,632.00	Small W.Course	177.32	117.00	88.26

S. No.	Project Name	District	Block	Basin	Sub-basin	Class	Latitude (DD)	Longitude (DD)	Ht. above Lowest Foundation (m)	Length of Dam (m)	Gross Storage Capacity (Mm^3)	Live Storage Capacity (Mm^3)	Reservoir Area at FRL (km^2)	Design Spilway Capacity (cusecs)	Length of Canal System (km)	Command Area (ha)		
																GCA	CCA	ICA
1	2	3	4	5	6	7	9	10	11	12	13	14	15	16	17	18	19	20
3065	Gulab Sagar Pachewar	TONK	Malpura	Banas	Mashi	MINOR	26.457040	75.228973	2.13	2,314.00	0.23	0.23	0.10	1,149.00	Small W.Course	101.21	49.00	32.38
3068	Hanutia Pachewar	TONK	Malpura	Banas	Mashi	MINOR	26.445850	75.339773	3.20	1,478.00	0.51	0.51	0.16	1,625.00	Small W.Course	219.00	72.80	73.00
3076	Jawani Sagar	TONK	Malpura	Banas	Mashi	MINOR	26.479960	75.341825	3.20	1,073.00	0.20	0.20	0.06	849.00	Small W.Course	97.16	44.50	28.34
3085	Kerowali Nadi	TONK	Malpura	Banas	Mashi	MINOR	26.356282	75.550062	3.25	862.00	0.14	0.14	0.04	501.00	Small W.Course	13.00	8.50	9.00
3089	Kirawal Sagar	TONK	Malpura	Banas	Mashi	MINOR	26.458206	75.412477	6.30	2.47	6.51	6.51	15.33	614.00	18.90	2,794.00	1,628.10	931.17
3099	Malik Sagar	TONK	Malpura	Banas	Mashi	MINOR	26.518595	75.307999	2.13	3,701.00	0.40	0.40	0.18	1,510.00	Small W.Course	153.84	56.70	57.00
3133	Ram Sagar Lawa	TONK	Malpura	Banas	Mashi	MINOR	26.351844	75.532721	3.35	190.00	0.42	0.42	0.13		1.28	121.46	83.00	80.97
3176	Ratanpura	TONK	Malpura	Banas	Mashi	Minor	26.424995	75.410393	3.96	1,797.00	0.28	0.28	0.07	1,577.00	Small W.Course	105.26	53.00	40.48
3154	Shel Sagar	TONK	Malpura	Banas	Mashi	MINOR	26.459406	75.300506	3.35	1,432.00	0.23	0.23	0.07	1,152.00	Small W.Course	81.00	50.60	32.38
3155	Shiv Sagar Lawn	TONK	Malpura	Banas	Mashi	MINOR	26.398241	75.592152	3.35	1,925.00	0.41	0.30	0.08	1,675.00	Small W.Course	53.00	56.60	27.12
3166	Sultan Sagar	TONK	Malpura	Banas	Mashi	MINOR	26.377391	75.489702	4.27	2,141.00	0.27	0.25	0.06	1,530.00	Small W.Course	417.00	290.60	173.25
3174	Vijay Sagar Lawn	TONK	Malpura	Banas	Mashi	MINOR	26.377421	75.574529	3.65	2,223.00	0.71	0.71	0.19	6,800.00	2.44	101.21	66.90	59.51
3033	Bidoli	TONK	Niwai	Banas	Mashi	MINOR	26.421294	75.863889	5.00	1.92	2.84	5.46	8.37	297.00		715.00	607.80	374.00
3045	Dangarthal	TONK	Niwai	Banas	Mashi	MINOR	26.373045	75.796457	3.96	2,164.00	0.54	0.54	0.14	2,333.00	3.50	340.00	129.50	129.55
3016	Bagri	TONK	Tonk	Banas	Mashi	MINOR	26.328759	75.793008	3.31	1,372.00	0.85	1.61	0.21	4,414.00	3.29	202.43	156.20	97.16
3038	Borkhandi Klan	TONK	Tonk	Banas	Mashi	MINOR	26.317911	75.597474	3.96	2,073.00	0.59	0.57	0.14	2,000.00	2.29	81.00	80.90	60.73
3077	Jhairana	TONK	Tonk	Banas	Mashi	MINOR	26.283333	75.641667	3.35	2,195.00	0.71	0.71	0.21	2,821.00	Small W.Course	161.94	161.90	80.97
	Sub Basin Total										**301.04**	**96.23**				**17,528.50**	**20,390.65**	**7,326.30**
1696	Churas	DAUSA	Dausa	Banas	Morel	MINOR	26.757668	76.340054				2.40					290.30	
1704	Jhilmili	DAUSA	Dausa	Banas	Morel	MINOR	26.791285	76.315146				6.34					1,182.50	
1727	Papada	DAUSA	Dausa	Banas	Morel	Minor	26.797387	76.432472	NA	2,100.00	2.00	1.17	NA	112.74	3.65	NA	251.00	40.48
1694	Binori Sagar	DAUSA	Lalsot	Banas	Morel	MINOR	26.533333	76.408333				3.60					890.30	
1724	Diwachali	DAUSA	Lalsot	Banas	Morel	NA	26.444344	76.342889				4.64					663.00	
1698	Dokhan Sagar	DAUSA	Lalsot	Banas	Morel	MINOR	26.560302	76.372399				1.10					263.00	
1713	Rahuwas	DAUSA	Lalsot	Banas	Morel	MINOR	26.711665	76.325601	12.20	1,830.00	5.35	4.35	NA	252.50	5.00	934.00	850.00	618.00
1726	Sintholi	DAUSA	Lalsot	Banas	Morel	Minor	26.690387	76.169028				2.40					528.00	
1858	Bhav sagar	JAIPUR	Amber	Banas	Morel	MINOR	26.995183	75.835228				2.89					24.30	
1866	Bund Talab	JAIPUR	Amber	Banas	Morel	MINOR	26.982704	75.848124				0.23					16.00	
1906	Kukas	JAIPUR	Amber	Banas	Morel	MINOR	27.000160	75.881212			1.92	1.92					485.60	596.00
1912	Man Sagar	JAIPUR	Amber	Banas	Morel	MINOR	26.963296	75.888916	15.50		2.40	2.32		301.82		835.00	728.40	664.00
1931	Ram sagar	JAIPUR	Amber	Banas	Morel	MINOR	26.993221	75.861697				0.34					40.00	
1881	Dubli Tank	JAIPUR	Bassi	Banas	Morel	MINOR	26.790634	76.108718			2.54	2.50		7,108.00			456.90	365.00
1886	Gudanallah	JAIPUR	Bassi	Banas	Morel	MINOR	26.874444	76.037500				0.77					171.90	
1889	Hanuman Sagar Bhandediya	JAIPUR	Bassi	Banas	Morel	MINOR	26.738959	75.979266				0.90					80.00	
1956	Hingoti	JAIPUR	Bassi	Banas	Morel	Minor	26.705366	76.145868				0.68					258.00	
1894	Jahajwara	JAIPUR	Bassi	Banas	Morel	MINOR	26.905883	76.162754				0.65					158.40	
1900	Kanota	JAIPUR	Bassi	Banas	Morel	MINOR	26.866686	75.948741	14.79		14.13	12.42		1,511.45		2,266.32	1,951.00	
1904	Kherli	JAIPUR	Bassi	Banas	Morel	MINOR	26.847556	76.031900				0.17					40.60	
1907	Kunthara Tank	JAIPUR	Bassi	Banas	Morel	MINOR	26.889994	75.979361				0.59					303.20	
1926	Patan Tank	JAIPUR	Bassi	Banas	Morel	MINOR	26.796941	76.150831			5.19	5.19		17,928.00		137.68	1,234.30	742.00
1891	Haolav	JAIPUR	Chaksu	Banas	Morel	MINOR	26.637842	75.952290				0.25					76.80	
1909	Lambia	JAIPUR	Chaksu	Banas	Morel	MINOR	26.578127	75.958734				0.82					281.30	
1952	Prethvi Pura	JAIPUR	Chaksu	Banas	Morel	Minor	26.564557	76.064358	9.83	573.00	0.58	0.18		67.58		122.00	41.00	152.00
1932	Ram Sagar Chandlai	JAIPUR	Chaksu	Banas	Morel	MINOR	26.699213	75.868195				2.04					449.70	
1941	Rawat wala	JAIPUR	Chaksu	Banas	Morel	MINOR	26.617334	75.915533				0.80					192.20	
1943	Sheel Ki Dungri	JAIPUR	Chaksu	Banas	Morel	MINOR	26.657763	75.967448	19.80		4.17	0.50				180.00	1,068.30	60.00
1944	Shiv Ki Dungri	JAIPUR	Chaksu	Banas	Morel	MINOR	26.632648	75.934288			2.72	2.30		6,991.00		375.51	445.10	
1945	Shyampura	JAIPUR	Chaksu	Banas	Morel	MINOR	26.583333	76.116667				1.39					274.70	
1857	Bhanpur	JAIPUR	Jamwa Ramgarh	Banas	Morel	MINOR	27.074923	75.951942				0.79					189.00	
1887	Gullar	JAIPUR	Sanganer	Banas	Morel	MINOR	26.794504	75.832819			113.91	0.20		933.00			33.20	
1937	Ramchandar Pura	JAIPUR	Sanganer	Banas	Morel	MINOR	26.785556	75.858333	DiversionDam			0.40		NA			76.00	
2434	Gendol	KARAULI	Nadoti	Banas	Morel	MINOR	26.599131	76.667544				2.52					892.00	
2468	Raisana	KARAULI	Nadoti	Banas	Morel	Minor	26.691858	76.564276				0.51					70.00	
2460	Ralsena	KARAULI	Nadoti	Banas	Morel	MINOR	26.707278	76.557384				0.51					20.20	
2426	Baloti	KARAULI	Sapotra	Banas	Morel	MINOR	26.384728	76.758432				0.80					140.80	

S. No.	Project Name	District	Block	Basin	Sub-basin	Class	Latitude (DD)	Longitude (DD)	Ht. above Lowest Foundation (m)	Length of Dam (m)	Gross Storage Capacity (Mm^3)	Live Storage Capacity (Mm^3)	Reservoir Area at FRL (km^2)	Design Spilway Capacity (cusecs)	Length of Canal System (km)	Command Area (ha)		
																GCA	CCA	ICA
1	2	3	4	5	6	7	9	10	11	12	13	14	15	16	17	18	19	20
2428	Bherunda	KARAULI	Sapotra	Banas	Morel	MINOR	26.350533	76.704239				1.94					416.80	
2429	Bhumender Sagar	KARAULI	Sapotra	Banas	Morel	MINOR	26.323959	76.742235				3.86					477.50	
2441	Kheda	KARAULI	Sapotra	Banas	Morel	MINOR	26.456972	76.818891				2.25					106.00	
2442	Khirkhiri	KARAULI	Sapotra	Banas	Morel	MINOR	26.355266	76.720234				2.96		NA			456.50	246.00
2474	Kudawada	KARAULI	Sapotra	Banas	Morel	Minor	26.386953	76.818714				0.39					45.00	
2445	Lower Dabra	KARAULI	Sapotra	Banas	Morel	MINOR	26.352987	76.773595				0.14					202.00	
2448	Mandawara	KARAULI	Sapotra	Banas	Morel	MINOR	26.446821	76.853055				0.20					163.10	
2457	Peedia Sheikpura	KARAULI	Sapotra	Banas	Morel	MINOR	26.397128	76.799692				0.66					189.40	
2464	Upper Dabra	KARAULI	Sapotra	Banas	Morel	MINOR	26.422702	76.848866				0.14					20.20	
2839	Akodia	SAWAI MADHOPUR	Bamanwas	Banas	Morel	MINOR	26.449046	76.584413	7.60	1,000.00	2.54	2.54	NA	191.02	4.75	607.00	569.23	368.00
2889	Gandal	SAWAI MADHOPUR	Bamanwas	Banas	Morel	Minor	26.575774	76.671818	7.30	2,680.00	2.56	2.56	NA	258.86	8.84	114.00	522.27	522.00
2885	Gudala	SAWAI MADHOPUR	Bamanwas	Banas	Morel	Minor	26.557454	76.448735	NA	1,310.00	0.18	0.18	NA	NA	1.50	2.73	65.00	41.00
2859	Gurla	SAWAI MADHOPUR	Bamanwas	Banas	Morel	MINOR	26.568302	76.425381				0.17					66.80	
2868	Nagtalai	SAWAI MADHOPUR	Bamanwas	Banas	Morel	MINOR	26.564764	76.669119	6.70	5,810.00	2.96	3.00	NA	1,865.50	4.13	1,076.00	809.40	459.00
2891	Naya Talab Liwali	SAWAI MADHOPUR	Bamanwas	Banas	Morel	Minor	26.564524	76.505347			0.72	0.72					279.35	
2871	Nazimwala	SAWAI MADHOPUR	Bamanwas	Banas	Morel	MINOR	26.561892	76.560598	NA	2,499.00	0.26	0.25	NA	NA	1.06	NA	80.30	NA
2873	New Tank Liwali	SAWAI MADHOPUR	Bamanwas	Banas	Morel	MINOR	26.540295	76.482342				0.71					449.20	
2875	Piplai	SAWAI MADHOPUR	Bamanwas	Banas	Morel	MINOR	26.504572	76.537422	NA	NA	0.59	0.88	NA	NA	NA	NA	119.00	NA
2878	Ranita	SAWAI MADHOPUR	Bamanwas	Banas	Morel	MINOR	26.622444	76.603976			0.75	0.80					202.30	
2879	Shankarsagar	SAWAI MADHOPUR	Bamanwas	Banas	Morel	MINOR	26.455325	76.540605	5.20	2,430.00	0.70	0.70	NA	116.58	1.34	169.00	126.00	107.00
2880	Sinhtoli	SAWAI MADHOPUR	Bamanwas	Banas	Morel	MINOR	26.569662	76.406823	6.00	1,460.00	2.55	2.41	NA	178.40	6.55	562.00	527.70	316.00
2881	Sobhag Sagar	SAWAI MADHOPUR	Bamanwas	Banas	Morel	MINOR	26.539499	76.465743	NA	NA	0.58	0.57	NA	NA	1.50	NA	70.00	42.00
2841	Badoti	SAWAI MADHOPUR	Bonli	Banas	Morel	MINOR	26.252834	76.378369			0.22	0.22					38.00	
2845	Bharja Gaddi	SAWAI MADHOPUR	Bonli	Banas	Morel	MINOR	26.255377	76.420442			0.18	0.18					20.20	
2846	Bhim Sagar	SAWAI MADHOPUR	Bonli	Banas	Morel	MINOR	26.310144	76.278522			0.21	0.20					64.80	
2852	Dhand sagar	SAWAI MADHOPUR	Bonli	Banas	Morel	MINOR	26.313406	76.395787	NA	1,402.00	0.18	0.18	NA	NA	NA	NA	38.00	NA
2853	Dhelra Sagar	SAWAI MADHOPUR	Bonli	Banas	Morel	MINOR	26.326757	76.385135	NA	1,890.00	0.61	0.61	NA	NA	NA	NA	114.00	NA
2855	Durga Sagar	SAWAI MADHOPUR	Bonli	Banas	Morel	MINOR	26.281778	76.395349	NA	2,377.00	0.20	0.19	NA	NA	NA	NA	38.00	NA
2857	Ghata Nainwari	SAWAI MADHOPUR	Bonli	Banas	Morel	MINOR	26.425025	76.267698			0.04	0.13					20.20	
2860	Jai Sagar	SAWAI MADHOPUR	Bonli	Banas	Morel	MINOR	26.366129	76.373700	NA	2,194.00	0.02	1.01	NA	NA	6.40	NA	190.00	NA
2863	Kharila	SAWAI MADHOPUR	Bonli	Banas	Morel	MINOR	26.327250	76.288868	NA	1,524.00	0.28	0.28	NA	NA	1.07	NA	100.00	NA
2864	Moria Manjulla	SAWAI MADHOPUR	Bonli	Banas	Morel	MINOR	26.421286	76.158580	NA	3,048.00	0.40	0.40	NA	NA	1.55	195.00	140.80	76.11
2867	Nagalao	SAWAI MADHOPUR	Bonli	Banas	Morel	MINOR	26.352460	76.313859	7.60	7,400.00	1.44	1.44	NA	108.50	5.00	405.00	343.90	202.00
2876	Ram Sagar	SAWAI MADHOPUR	Bonli	Banas	Morel	MINOR	26.332740	76.378640	NA	3,048.00	2.05	2.05	NA	NA	7.16	NA	399.00	NA
2843	Baniyawala	SAWAI MADHOPUR	Gangapur	Banas	Morel	MINOR	26.543757	76.756128	4.90	3,005.00	0.99	0.99	NA	301.87	4.50	462.00	346.80	202.00
2848	Bhutka	SAWAI MADHOPUR	Gangapur	Banas	Morel	MINOR	26.592349	76.719419				0.12					40.70	
2850	Chandpura	SAWAI MADHOPUR	Gangapur	Banas	Morel	MINOR	26.540205	76.816295			4.74	4.80					1,369.50	
2854	Dobe	SAWAI MADHOPUR	Gangapur	Banas	Morel	MINOR	26.487479	76.810709			0.31	0.31					135.90	
2861	Jeewali	SAWAI MADHOPUR	Gangapur	Banas	Morel	MINOR	26.504034	76.836710			0.42	0.42					58.70	
2865	Moti Sagar	SAWAI MADHOPUR	Gangapur	Banas	Morel	MINOR	26.539748	76.681527			6.49	6.49					323.00	
2872	Nazimwala (GLC)	SAWAI MADHOPUR	Gangapur	Banas	Morel	MINOR	26.500689	76.719246	NA	2,438.00	0.65	0.80	NA	NA	3.43	NA	289.40	172.00
2882	Talaka	SAWAI MADHOPUR	Gangapur	Banas	Morel	MINOR	26.571592	76.726726				0.30					29.50	
2884	Tori	SAWAI MADHOPUR	Gangapur	Banas	Morel	MINOR	26.477727	76.667716				0.88					235.50	
2886	Toxi	SAWAI MADHOPUR	Gangapur	Banas	Morel	Minor	26.501277	76.785823	NA	2,286.00	0.86	0.86	NA	NA	1.76	NA	238.00	141.70
	Sub Basin Total										**189.59**	**122.47**				**8,443.24**	**25,653.95**	**6,132.29**
5	Alakh Sagar Balupura	AJMER	Arain	Banas	Sodra	MINOR	26.372285	75.084246	4.69	2,400.00	0.31	0.31	NA	73.69	2.13	117.36	84.90	46.55
223	Lapala Tank Bantheli	AJMER	Arain	Banas	Sodra	MINOR	26.271766	75.086411	4.57	1,890.00	0.91	0.90	NA	64.04	6.40	129.50	129.50	103.60
232	Madan Sagar Akeri	AJMER	Arain	Banas	Sodra	MINOR	26.345994	75.031946	5.49	1,005.00	0.92	0.93	NA	89.51	1.25	423.50	223.40	129.50
251	Mundoti	AJMER	Arain	Banas	Sodra	MINOR	26.199505	75.128602	NA	NA	2.28	2.73	NA	467.85	6.40	1,600.00	972.00	873.16
255	Narain Sagar Dasook	AJMER	Arain	Banas	Sodra	MINOR	26.343899	75.091248	5.03	660.00	0.55	0.60	NA	57.17	0.30	250.91	125.50	74.08
266	Naya Talab Jhironta	AJMER	Arain	Banas	Sodra	MINOR	26.328432	75.062263	5.49	2,040.00	1.24	1.20	NA	104.74	0.60	522.06	261.00	176.45
278	Nayasagar Mothi	AJMER	Arain	Banas	Sodra	MINOR	26.391245	75.125794				0.20					62.75	
389	Ratansagar Devria	AJMER	Arain	Banas	Sodra	Minor	26.220036	75.092126	NA	NA	0.66	0.55	NA	156.56	1.32	246.00	161.08	113.00
390	Sanwarsagar Dothali	AJMER	Arain	Banas	Sodra	Minor	26.297306	75.068622				0.34					113.00	
3179	Baldasali	TONK	Malpura	Banas	Sodra	Minor	26.216542	75.338087	2.74	683.00	0.13	0.12	0.04	1,319.00	Small W.Course	42.91	26.00	17.40
3027	Bhamalao Ganwar	TONK	Malpura	Banas	Sodra	MINOR	26.351297	75.329259	1.98	1,316.00	2.46	0.20	1.24	1,149.00	Small W.Course	121.45	49.00	28.34
3030	Bhawalpur Kenviala	TONK	Malpura	Banas	Sodra	MINOR	26.208969	75.485757			1.74	1.70					411.20	
3031	Bhawani Sagar	TONK	Malpura	Banas	Sodra	MINOR	26.364168	75.409048	3.96	2,346.00	0.19	0.20	0.05	1,415.00	Small W.Course	64.37	56.00	55.87
3034	BirsaliBirsali	TONK	Malpura	Banas	Sodra	MINOR	26.218034	75.321812			0.12	0.12					26.00	
3053	Dhbru Sagar	TONK	Malpura	Banas	Sodra	MINOR	26.248593	75.226211	3.66	2,253.00	0.54	0.54	0.15	6,043.00	Small W.Course	230.76	97.10	76.92
3059	Fateh Sagar	TONK	Malpura	Banas	Sodra	MINOR	26.258843	75.214330	2.13	1,641.00	0.14	0.14	0.07	712.00	Small W.Course	56.68	33.00	20.24
3067	Halolao Kalmada	TONK	Malpura	Banas	Sodra	MINOR	26.248575	75.536545	4.80	2.55	2.09	2.09	7.40	38.00	9.60	672.00	404.70	302.02

S. No.	Project Name	District	Block	Basin	Sub-basin	Class	Latitude (DD)	Longitude (DD)	Ht. above Lowest Foundation (m)	Length of Dam (m)	Gross Storage Capacity (Mm^3)	Live Storage Capacity (Mm^3)	Reservoir Area at FRL (km^2)	Design Spilway Capacity (cusecs)	Length of Canal System (km)	Command Area (ha)		
																GCA	CCA	ICA
1	2	3	4	5	6	7	9	10	11	12	13	14	15	16	17	18	19	20
3074	Hindalao	TONK	Malpura	Banas	Sodra	MINOR	26.232813	75.257236	2.66	2,896.00	0.40	0.40	0.15	1,908.00	Small W.Course	150.00	64.70	57.00
3093	Lambia Junardar	TONK	Malpura	Banas	Sodra	MINOR	26.226412	75.217868	4.57	2,163.00	0.34	0.34	0.07	2,403.00	Small W.Course	85.00	67.20	49.00
3094	Lambia Phuttia Hatki	TONK	Malpura	Banas	Sodra	MINOR	26.329087	75.326541	3.96	1,829.00	0.25	0.22	0.06	260.00	2.27	186.23	105.20	72.87
3103	Megh Sagar Diggi	TONK	Malpura	Banas	Sodra	MINOR	26.378506	75.428111	3.65	902.00	0.17	0.17	0.05	785.00	Small W.Course	61.00	38.40	24.00
3105	Mevaliyer Sita Rampura	TONK	Malpura	Banas	Sodra	MINOR	26.268751	75.294449				0.34					48.60	
3106	Mewalia Naya Gaon	TONK	Malpura	Banas	Sodra	MINOR	26.283562	75.277705			0.36	0.36					52.00	
3111	Naghphani	TONK	Malpura	Banas	Sodra	MINOR	26.267847	75.478633	2.44	2,833.00	1.52	1.50	0.62	1,247.00	Small W.Course	611.34	236.30	217.00
3117	Nepolao Bagri	TONK	Malpura	Banas	Sodra	MINOR	26.285927	75.215354	3.66	1,340.00	0.23	0.23	0.06	1,412.00	0.60	67.20	51.80	32.38
3124	Partap Sagar Diggi	TONK	Malpura	Banas	Sodra	MINOR	26.380317	75.458395	4.27	1,996.00	0.23	0.23	0.05	1,900.00	Small W.Course	64.77	49.80	50.00
3131	Ram Sagar Ganwar	TONK	Malpura	Banas	Sodra	MINOR	26.374130	75.332559	4.80	2.43	2.46	2.46	7.91	183.00	10.71	761.00	465.40	352.23
3134	Ram Sagar Morla	TONK	Malpura	Banas	Sodra	MINOR	26.327000	75.190716			0.51	0.50					105.20	
3139	Roophali	TONK	Malpura	Banas	Sodra	MINOR	26.299589	75.286804	3.66	2,600.00	0.60	0.59	0.16	2,198.00	Small W.Course	218.62	141.60	85.42
3150	Sardarpura	TONK	Malpura	Banas	Sodra	MINOR	26.329877	75.364024	5.50	480.00	0.20	0.20	0.26	5,600.00	5.30	105.00	53.00	60.00
3156	Shiv Sagar Morla	TONK	Malpura	Banas	Sodra	MINOR	26.360921	75.187665	3.96	1,513.00	0.28	0.28	0.07	3,495.00	Small W.Course	91.00	43.30	40.48
3158	Sindholia	TONK	Malpura	Banas	Sodra	MINOR	26.325061	75.247833	4.57	1,340.00	0.28	0.34	0.06	1,640.00	Small W.Course	101.21	52.60	40.48
3171	Tilanju	TONK	Malpura	Banas	Sodra	MINOR	26.185400	75.476781	3.04	1,840.00	0.28	0.28	0.09	2,253.00	2.59	113.36	52.60	40.48
3017	Bala Sager Sanwariya	TONK	Todaraisingh	Banas	Sodra	MINOR	26.193065	75.242298	3.28	1,067.00	0.23	0.23	0.07		2.49	81.00	41.00	32.00
3020	Ban Ka Khera	TONK	Todaraisingh	Banas	Sodra	MINOR	26.175098	75.434173	3.35	2,051.00	0.28	0.28	0.08	2,028.00	2.32	85.00	52.50	28.00
3090	Kuhada	TONK	Todaraisingh	Banas	Sodra	MINOR	26.162490	75.592456	3.66	2,011.00	0.23	0.23	0.06	1,530.00	Small W.Course	71.00	33.60	26.00
3104	Mehru Sagar	TONK	Todaraisingh	Banas	Sodra	MINOR	26.182349	75.340830	4.57	1,432.00	0.99	0.99	3.21	3,715.00	4.27	354.25	174.00	141.70
3115	Naya Talab Panwaliya	TONK	Todaraisingh	Banas	Sodra	MINOR	26.137585	75.372528	3.35	1,570.00	0.26	0.25	0.08		0.60	109.00	54.60	36.00
3119	Paldraheda	TONK	Todaraisingh	Banas	Sodra	MINOR	26.146541	75.482750	3.66	2,332.00	0.54	0.54	0.15	885.00	Small W.Course	234.81	97.10	76.92
3125	Pratap Pura	TONK	Todaraisingh	Banas	Sodra	MINOR	26.199869	75.282255	3.04	2,318.00	0.25	0.25	0.08	630.00	Small W.Course	114.17	54.60	36.48
3138	Rendiliya Rampura	TONK	Todaraisingh	Banas	Sodra	MINOR	26.153424	75.457180	3.96	2,544.00	0.44	0.44	0.11	625.00	4.66	178.13	86.90	62.35
3161	Sohadra	TONK	Todaraisingh	Banas	Sodra	MINOR	26.191880	75.563966			6.14	6.50					1,131.00	
3164	Subdand Topa	TONK	Todaraisingh	Banas	Sodra	MINOR	26.167247	75.556125	3.96	1,570.00	0.26	0.26	2.35	1,720.00	4.11	109.00	60.70	38.00
3168	Tamoliya Panwaliya	TONK	Todaraisingh	Banas	Sodra	MINOR	26.147911	75.331089	3.04	1,829.00	0.24	0.20	0.09		0.82	96.00	57.10	38.00
3118	Nimbhera	TONK	Tonk	Banas	Sodra	MINOR	26.234173	75.633986	3.96	1,829.00	0.57	0.57	0.14	12,129.00	1.52	80.97	80.90	40.48
	Sub Basin Total										**32.83**	**32.05**				**8,606.56**	**6,787.83**	**3,694.40**
	Basin Total										**1,448.43**	**1,213.20**				**142,329.55**	**237,434.83**	**74,030.86**
394	Adoli	ALWAR	Kathumar	Banganga	Banganga	MINOR	27.267998	76.872909	2.43	394.00	0.23	0.23	N.A	N.A	Not Canal	N.A	38.00	N.A
421	Chhattarpura	ALWAR	Kathumar	Banganga	Banganga	MINOR	27.262690	77.121082				0.20					38.00	
422	Dabara	ALWAR	Kathumar	Banganga	Banganga	MINOR	27.345813	77.206268				0.94					95.00	
430	Gala Khera	ALWAR	Kathumar	Banganga	Banganga	MINOR	27.211963	77.004634	1.92	1,149.00	0.30	0.30	N.A	N.A	Not Canal	N.A	71.50	N.A
448	Jatwara	ALWAR	Kathumar	Banganga	Banganga	MINOR	27.262261	76.896956	2.43	415.50	0.65	0.65	N.A	N.A	Not Canal	N.A	155.50	N.A
490	Pritam Pura	ALWAR	Kathumar	Banganga	Banganga	MINOR	27.192952	77.030296	0.91	915.00	1.39	1.38	N.A	N.A	Not Canal	N.A	297.70	N.A
493	Ram Sagar Sumushi	ALWAR	Kathumar	Banganga	Banganga	MINOR	27.189287	76.993830	1.92	1,131.00	0.30	0.30	N.A	4,385.00	Not Canal	N.A	71.60	N.A
502	Salwari	ALWAR	Kathumar	Banganga	Banganga	MINOR	27.213158	76.960081	2.13	1,320.00	0.12	0.12	N.A	N.A	Not Canal	N.A	29.00	N.A
513	Tasai	ALWAR	Kathumar	Banganga	Banganga	MINOR	27.362911	77.090941	1.82	3,240.00	1.40	0.40	N.A	N.A	Not Canal	N.A	47.00	N.A
518	Titpuri	ALWAR	Kathumar	Banganga	Banganga	MINOR	27.371551	77.001606	3.00	2,265.00	1.22	1.22	N.A	N.A	Not Canal	N.A	290.20	N.A
519	Toda Bund	ALWAR	Kathumar	Banganga	Banganga	MINOR	27.355752	76.920980	N.A		0.85	0.85	N.A	N.A	Not Canal	N.A	202.50	N.A
522	Tusari	ALWAR	Kathumar	Banganga	Banganga	MINOR	27.344908	77.102656	0.91	5,300.00	3.00	3.01	N.A				71.82	489.67
400	Atal Bund	ALWAR	Lachhmangarh	Banganga	Banganga	MINOR	27.367339	76.823912	1.82	1,146.00	0.41	0.41	N.A	N.A	Not Canal	N.A	43.10	N.A
405	Bagh Singh Teliwala	ALWAR	Lachhmangarh	Banganga	Banganga	MINOR	27.385896	76.808710				1.21					228.00	
416	Bichgaon	ALWAR	Lachhmangarh	Banganga	Banganga	MINOR	27.279167	76.815278	1.82	2,100.00	1.04	1.04	N.A	N.A	Not Canal	N.A	148.00	N.A
432	Ghatbai Bund	ALWAR	Lachhmangarh	Banganga	Banganga	MINOR	27.458787	76.802451	3.00	1,260.00	1.75	1.75	N.A	N.A	Not Canal	N.A	342.00	N.A
433	Gor Pahari	ALWAR	Lachhmangarh	Banganga	Banganga	MINOR	27.376881	76.835630	1.82	3,450.00	0.41	0.41	N.A	N.A	Not Canal	N.A	76.00	N.A
437	Harsana	ALWAR	Lachhmangarh	Banganga	Banganga	MINOR	27.307227	76.836363	1.37	2,250.00	0.93	0.93	N.A	N.A	Not Canal	N.A	163.00	N.A
450	Jhalatal	ALWAR	Lachhmangarh	Banganga	Banganga	MINOR	27.237056	76.825526	N.A	2,400.00	0.24	0.25	N.A	N.A	Not Canal	N.A	48.00	N.A
454	Kanwara	ALWAR	Lachhmangarh	Banganga	Banganga	MINOR	27.372702	76.885490	2.86	1,320.00	0.12	0.12	N.A	N.A	Not Canal	N.A	19.00	N.A
466	Lachhmangarh Bund	ALWAR	Lachhmangarh	Banganga	Banganga	MINOR	27.381877	76.859511	1.60	5,100.00	3.00	2.94	N.A				551.00	473.07
468	Lily Bund	ALWAR	Lachhmangarh	Banganga	Banganga	MINOR	27.358296	76.886098	1.06	4,020.00	0.43	0.43	N.A	N.A	Not Canal	N.A	76.00	N.A
495	Ramlal Wala	ALWAR	Lachhmangarh	Banganga	Banganga	MINOR	27.349501	76.822482	10.36	3,510.00	0.44	0.43	N.A	N.A	Not Canal	N.A	131.00	N.A
501	Sajjan Puri	ALWAR	Lachhmangarh	Banganga	Banganga	MINOR	27.345289	76.851393	0.30	1,020.00	0.09	0.09	N.A	N.A	Not Canal	N.A	171.00	N.A
527	Bigota	ALWAR	Rajgarh	Banganga	Banganga	Minor	27.127689	76.459526	5.80	765.00	1.56	1.40	N.A		1.80	575.00	410.00	260.00
418	Birkhiri	ALWAR	Rajgarh	Banganga	Banganga	MINOR	27.073282	76.340357				1.07					265.50	

S. No.	Project Name	District	Block	Basin	Sub-basin	Class	Latitude (DD)	Longitude (DD)	Ht. above Lowest Foundation (m)	Length of Dam (m)	Gross Storage Capacity (Mm^3)	Live Storage Capacity (Mm^3)	Reservoir Area at FRL (km^2)	Design Spilway Capacity (cusecs)	Length of Canal System (km)	Command Area (ha)		
																GCA	CCA	ICA
1	2	3	4	5	6	7	9	10	11	12	13	14	15	16	17	18	19	20
425	Dewti Bund	ALWAR	Rajgarh	Banganga	Banganga	MINOR	27.168005	76.498834				5.88					1,344.90	
444	Jai Sagar	ALWAR	Rajgarh	Banganga	Banganga	MINOR	27.171062	76.293197	12.08	376.00	6.57	6.53	N.A	141.60	10,300.00	1,336.67	946.60	567.99
460	Kho Bund	ALWAR	Rajgarh	Banganga	Banganga	MINOR	27.193644	76.368968	2.43	720.00	0.14	0.14	N.A	60.90	Not Canal	N.A	31.50	N.A
471	Man Sarowar	ALWAR	Rajgarh	Banganga	Banganga	MINOR	27.241945	76.390258	6.55	1,500.00	9.60	9.08	N.A	424.50	2,750.00	867.56	842.90	820.17
472	Mangalsar	ALWAR	Rajgarh	Banganga	Banganga	MINOR	27.218426	76.419609	17.37	64.00	18.68	0.45	N.A	396.20	184,160.00	3,318.98	157.00	574.94
482	Nirmla Bund	ALWAR	Rajgarh	Banganga	Banganga	MINOR	27.186358	76.577093				0.05					3.00	
484	Patwari Ka Naka	ALWAR	Rajgarh	Banganga	Banganga	MINOR	27.232446	76.468782	3.13	156.00	0.07	0.07	N.A	N.A	Not Canal	N.A	16.00	N.A
492	Rajroli	ALWAR	Rajgarh	Banganga	Banganga	MINOR	27.247372	76.428993	3.65	1,155.00	0.38	0.37	N.A	141.50	Not Canal	N.A	32.80	N.A
510	Surer Lower	ALWAR	Rajgarh	Banganga	Banganga	MINOR	27.173365	76.633247	3.35	750.00	0.35	0.35	N.A	N.A	Not Canal	N.A	72.80	N.A
511	Surer Upper	ALWAR	Rajgarh	Banganga	Banganga	MINOR	27.178568	76.616437	2.74	510.00	0.35	0.35	N.A	24.10	Not Canal	N.A	24.30	N.A
512	Talab Bund	ALWAR	Rajgarh	Banganga	Banganga	MINOR	27.218000	76.455297	4.26	2,250.00	0.58	0.35	N.A	11.20	Not Canal	N.A	36.40	N.A
423	Danpur	ALWAR	Reni	Banganga	Banganga	MINOR	27.155446	76.792784				0.30					85.00	
424	Dera Bund	ALWAR	Reni	Banganga	Banganga	MINOR	27.160220	76.673775				0.85					45.30	
429	Dugduga	ALWAR	Reni	Banganga	Banganga	MINOR	27.123741	76.675008	1.52	1,869.00	0.30	0.30	N.A	N.A	Not Canal	N.A	72.40	N.A
431	Garhi Sawairam	ALWAR	Reni	Banganga	Banganga	MINOR	27.206492	76.806159	1.82	1,410.00	0.11	0.10	N.A	N.A	Not Canal	N.A	114.90	N.A
446	Jamboli	ALWAR	Reni	Banganga	Banganga	MINOR	27.146838	76.661772	3.65	67.50	0.29	0.29	N.A	N.A	Not Canal	N.A	23.10	N.A
467	Lakhnaka	ALWAR	Reni	Banganga	Banganga	MINOR	27.238536	76.682943	1.82	2,100.00	0.44	0.44	N.A	N.A	Not Canal	N.A	40.90	N.A
469	Macheri	ALWAR	Reni	Banganga	Banganga	MINOR	27.241089	76.666020	3.65	98.40	0.85	0.08	N.A	N.A	800.00	N.A	49.40	N.A
481	Nimbola	ALWAR	Reni	Banganga	Banganga	MINOR	27.143506	76.738925	1.52	2,940.00	0.33	0.33	N.A	N.A	2,000.00	N.A	40.00	N.A
530	Odpur	ALWAR	Reni	Banganga	Banganga	Minor	27.296777	76.670263		198.00	0.10	0.23	N.A	N.A	Not Canal	N.A	72.00	N.A
485	Pinan	ALWAR	Reni	Banganga	Banganga	MINOR	27.259012	76.748439	2.43	2,580.00	0.85	0.85	N.A	N.A	3,300.00	N.A	79.70	N.A
486	Pinas Nagal	ALWAR	Reni	Banganga	Banganga	MINOR	27.209877	76.731744	1.82	1,162.50	0.11	0.10	N.A	N.A	Not Canal	N.A	12.00	N.A
498	Reni New	ALWAR	Reni	Banganga	Banganga	MINOR	27.156589	76.732656				0.85					148.50	
499	Reni Old	ALWAR	Reni	Banganga	Banganga	MINOR	27.170417	76.736411				0.39					63.10	
500	Roopwas	ALWAR	Reni	Banganga	Banganga	MINOR	27.219945	76.750598	3.65	1,635.00	1.36	0.12	N.A	1,023.00	Not Canal	N.A	60.70	N.A
515	Thetra	ALWAR	Reni	Banganga	Banganga	MINOR	27.195536	76.737264	N.A	15.00	0.26	0.26	N.A	N.A	Not Canal	N.A	63.10	N.A
516	Thonsara	ALWAR	Reni	Banganga	Banganga	MINOR	27.171091	76.690279				0.85					202.50	
395	Agar Bund	ALWAR	Thanagazi	Banganga	Banganga	MINOR	27.294018	76.172213	N.A	701.10	2.88	2.88	N.A	13.20	2,800.00	N.A	252.90	N.A
398	Amka	ALWAR	Thanagazi	Banganga	Banganga	MINOR	27.288649	76.159161	6.25	385.00	1.43	1.31	N.A		4,500.00	326.00	288.00	259.00
449	Jetpur	ALWAR	Thanagazi	Banganga	Banganga	MINOR	27.239150	76.291374				2.49					518.40	
529	Kishori	ALWAR	Thanagazi	Banganga	Banganga	Minor	27.281881	76.300976		1,470.00	0.32	1.12	N.A	N.A	Not Canal	N.A	160.00	N.A
503	Samar Sarovar	ALWAR	Thanagazi	Banganga	Banganga	MINOR	27.216667	76.200000			1.13	1.06					379.00	
920	Jhangirpur	BHARATPUR	Bayana	Banganga	Banganga	MINOR	27.082355	77.302447	4.11	670.00	0.14	1.42		17,360.00		140.32	266.00	140.32
1008	Shekhpur	BHARATPUR	Bayana	Banganga	Banganga	MINOR	27.076798	77.290991				0.20					38.00	
1029	Dabara bund	BHARATPUR	Deeg	Banganga	Banganga	Minor	27.432598	77.207836	3.04	2.22	NA	0.40	NA	19.81	NA	NA	57.00	NA
914	Januthor	BHARATPUR	Deeg	Banganga	Banganga	MINOR	27.402017	77.223211	3.96	4,270.00	0.80	0.79	2.32	3,000.00	Nil	357.00	357.00	357.00
846	Ajau	BHARATPUR	Kumher	Banganga	Banganga	MINOR	27.240272	77.343121				2.54					1,215.00	
862	Bansrdi	BHARATPUR	Kumher	Banganga	Banganga	MINOR	27.263677	77.282053	3.35	3536	0.62	0.62	-	-	-	197	142.05	197
869	Bhandore	BHARATPUR	Kumher	Banganga	Banganga	MINOR	27.275000	77.458333	4.42	518	0.48	0.48	3.20	-	-	160	109.27	160
870	Bhatawali	BHARATPUR	Kumher	Banganga	Banganga	MINOR	27.241260	77.293190	3.89	1128	0.99	0.99	4.32	-	11.92	270	270.00	270
881	Borai	BHARATPUR	Kumher	Banganga	Banganga	MINOR	27.259738	77.427342	4.27	701	0.54	0.54	-	-	-	80	95.00	80
898	Dhanwara	BHARATPUR	Kumher	Banganga	Banganga	MINOR	27.277225	77.357715	4.08	4,510.00	0.50	0.50	-	-	Nil	903.00	89.20	903.00
907	Helak	BHARATPUR	Kumher	Banganga	Banganga	MINOR	27.223523	77.364823	3.05	2438	1.19	1.19	-	6680	-	291	196.68	291
908	Helak Roondh	BHARATPUR	Kumher	Banganga	Banganga	MINOR	27.270783	77.367998	3.35	4420	0.22	0.22	0.80	-	-	283	472.50	283
910	Husna	BHARATPUR	Kumher	Banganga	Banganga	MINOR	27.229765	77.312180	2.44	2,050.00	0.57	0.57	-	840.00	Nil	485.00	114.00	485.00
976	Pahuwa	BHARATPUR	Kumher	Banganga	Banganga	MINOR	27.259471	77.347447	2.44	1524	1.13	1.13	2.56	-	-	121	121.00	121
986	Raisis	BHARATPUR	Kumher	Banganga	Banganga	MINOR	27.234433	77.264021	3.96	3353	0.42	0.42	-	-	-	80	81.00	80
1003	Seh	BHARATPUR	Kumher	Banganga	Banganga	MINOR	27.256377	77.418124	3.96	1,340.00	1.84	1.84	1.76	-	Nil	647.00	640.00	647.00
849	Alipur	BHARATPUR	Nadbai	Banganga	Banganga	MINOR	27.105329	77.307140	2.89	1219	0.15	0.14	0.32	3170	-	20	19.00	20
1021	Aranda Hantra bundh	BHARATPUR	Nadbai	Banganga	Banganga	Minor	27.139932	77.213477	2.21	1372	0.14	0.14	-	3360	-	40	40.00	40
851	Aronda	BHARATPUR	Nadbai	Banganga	Banganga	MINOR	27.137027	77.210632	2.35	1829	0.33	0.34	0.16	1770	-	215	214.00	215
854	Bachhamdi	BHARATPUR	Nadbai	Banganga	Banganga	MINOR	27.089719	77.348403	3.96	1,220.00	1.53	1.53	1.60	1,466.00	Nil	809.00	1,350.00	809.00
857	Balera Lower	BHARATPUR	Nadbai	Banganga	Banganga	MINOR	27.208082	77.232737	1.83	1372	0.06	0.10	-	-	-	60	19.00	60
858	Balera Upper	BHARATPUR	Nadbai	Banganga	Banganga	MINOR	27.196649	77.229342	2.59	609	0.14	0.14	-	-	-	20	19.00	20
866	Bhadira	BHARATPUR	Nadbai	Banganga	Banganga	MINOR	27.300642	77.168577			0.11	0.11					19.00	
871	Bhauwa	BHARATPUR	Nadbai	Banganga	Banganga	MINOR	27.156309	77.334665			2.26	0.50					95.00	
1026	Chattarpur bund	BHARATPUR	Nadbai	Banganga	Banganga	Minor	27.257818	77.129509	2.44	1829	0.08	0.08	-	3959	-	14	14.00	14
895	Dehra	BHARATPUR	Nadbai	Banganga	Banganga	MINOR	27.141252	77.258455	2.83	1829	0.17	0.17	-	3249	-	201	81.00	201
906	Hantra	BHARATPUR	Nadbai	Banganga	Banganga	MINOR	27.143861	77.231708	1.84	640	0.42	0.10	-	1400	-	162	270.00	162
989	Rena	BHARATPUR	Nadbai	Banganga	Banganga	MINOR	27.154071	77.267657				0.11					19.00	
1001	Sarsera	BHARATPUR	Nadbai	Banganga	Banganga	MINOR	27.146145	77.171118	3.94	3,050.00	0.57	0.57	-	3,962.00	Nil	543.00	543.00	543.00
1007	Shahpur	BHARATPUR	Nadbai	Banganga	Banganga	MINOR	27.149559	77.311880	3.69	3,660.00	0.99	0.99	2.40	-	Nil	445.00	320.00	445.00
859	Banda	BHARATPUR	Rupbas	Banganga	Banganga	MINOR	27.069263	77.512996	3.35	1768	2.42	2.42	-	650	-	299	299.00	299
865	Baseri	BHARATPUR	Rupbas	Banganga	Banganga	MINOR	27.088907	77.362972			0.96	0.20					38.00	
874	Bhot	BHARATPUR	Rupbas	Banganga	Banganga	MINOR	27.130248	77.433451			0.18	0.10					19.00	
892	Daulatgarh	BHARATPUR	Rupbas	Banganga	Banganga	MINOR	27.090185	77.502882			0.25	0.30					57.00	
902	Gehlau	BHARATPUR	Rupbas	Banganga	Banganga	MINOR	27.081765	77.462996	1.01	5,280.00	0.76	0.30	NIL	480.00	NIL	64.51	57.00	64.51

S. No.	Project Name	District	Block	Basin	Sub-basin	Class	Latitude (DD)	Longitude (DD)	Ht. above Lowest Foundation (m)	Length of Dam (m)	Gross Storage Capacity (Mm^3)	Live Storage Capacity (Mm^3)	Reservoir Area at FRL (km^2)	Design Spilway Capacity (cusecs)	Length of Canal System (km)	Command Area (ha)		
																GCA	CCA	ICA
1	2	3	4	5	6	7	9	10	11	12	13	14	15	16	17	18	19	20
933	Khanuwa	BHARATPUR	Rupbas	Banganga	Banganga	MINOR	27.043898	77.514622				4.59					876.00	
967	Nekur	BHARATPUR	Rupbas	Banganga	Banganga	MINOR	27.058441	77.392647	3.58	2,010.00	2.22	2.22	3.20	NA	1.50	324.00	324.00	324.00
1018	Sahana	BHARATPUR	Rupbas	Banganga	Banganga	Minor	27.120394	77.374767				1.59					64.00	
1004	Sena	BHARATPUR	Rupbas	Banganga	Banganga	MINOR	27.119173	77.408876				0.30					57.00	
1015	Sukhawali	BHARATPUR	Rupbas	Banganga	Banganga	MINOR	27.156480	77.441279	2.01	2,970.00	0.76	1.61	NIL	280.00	NIL	32.25	271.00	32.25
842	Addi	BHARATPUR	Sewar	Banganga	Banganga	MINOR	27.207069	77.434920	3.96	610.00	0.11	0.11	0.24	-	Nil	330.00	33.00	330.00
1019	Ajan bundh	BHARATPUR	Sewar	Banganga	Banganga	Minor	27.097779	77.480997	3.20	4,210.00	2.54	2.54	3.20	-	Nil	329.00	1,920.00	329.00
845	Ajan Upper	BHARATPUR	Sewar	Banganga	Banganga	MINOR	27.108333	77.508333	3.50	4,570.00	2.56	2.56	3.36	6,984.00	Nil	330.00	494.00	330.00
1020	Anah bundh	BHARATPUR	Sewar	Banganga	Banganga	Minor	27.218988	77.446546	2.43	1585	0.09	0.09	0.44	-	-	36	56.00	36
855	Bahanera	BHARATPUR	Sewar	Banganga	Banganga	MINOR	27.164632	77.562287	2.74	4,880.00	3.93	3.90	-	1,400.00	Nil	955.00	741.00	955.00
887	Chakkaji	BHARATPUR	Sewar	Banganga	Banganga	MINOR	27.120747	77.542904	3.35	2,000.00	2.03	2.04	-	1,455.00	30.50	768.00	380.00	768.00
1027	Chiksana bundh	BHARATPUR	Sewar	Banganga	Banganga	Minor	27.185494	77.647912	4.80	520.00	14.15	14.15	8.32	-	Nil	810.00	810.00	810.00
909	Hindola	BHARATPUR	Sewar	Banganga	Banganga	MINOR	27.206414	77.360922	3.05	3,140.00	2.19	2.19	-	4,754.00	Nil	323.00	540.00	323.00
957	Moti Jheel	BHARATPUR	Sewar	Banganga	Banganga	MINOR	27.235304	77.476704	4.57	5639	6.68	1.00	9.6	-	4.5	259	259.00	259
959	Murwara	BHARATPUR	Sewar	Banganga	Banganga	MINOR	27.225271	77.442148	3.25	3,660.00	3.45	3.45	4.00	-	17.79	890.00	890.00	890.00
981	Par	BHARATPUR	Sewar	Banganga	Banganga	MINOR	27.148045	77.416599	1.72	2,430.00	0.36	0.35	NIL	593.00	NIL	774.19	76.00	774.19
1005	Sewar Lower	BHARATPUR	Sewar	Banganga	Banganga	MINOR	27.199578	77.426513	3.31	3810	2.00	2.01	-	3637	-	242	242.00	242
1006	Sewar Upper	BHARATPUR	Sewar	Banganga	Banganga	MINOR	27.181865	77.439904	4.57	5,370.00	5.66	5.66	8.00	-	Nil	729.00	800.00	729.00
1009	Sheorana	BHARATPUR	Sewar	Banganga	Banganga	MINOR	27.175391	77.451784				0.48					95.00	
1012	Sinpini	BHARATPUR	Sewar	Banganga	Banganga	MINOR	27.175067	77.375876	2.51	2377	0.11	0.11	-	-	-	40	40.00	40
847	Ajronda	BHARATPUR	Weir	Banganga	Banganga	MINOR	27.033110	77.252555	3.35	1,768.00	0.14	0.39	NIL	3,962.00	NIL	97.95	299.50	97.95
852	Atari pura	BHARATPUR	Weir	Banganga	Banganga	MINOR	27.072609	77.114914	2.15	5,181.00	2.43	2.43	NIL	1,852.00	NIL	266.00	445.50	266.00
856	Bajhera Bund	BHARATPUR	Weir	Banganga	Banganga	MINOR	27.019073	77.202379	2.74	2,012.00	0.34	0.30	NIL	NIL	NIL	108.00	57.00	108.00
861	Bansi	BHARATPUR	Weir	Banganga	Banganga	MINOR	27.040762	77.237315	3.96	1,463.00	0.71	0.43	NIL	3,689.00	NIL	161.00	270.00	161.00
863	Baroli Bund	BHARATPUR	Weir	Banganga	Banganga	MINOR	27.062035	77.102018	3.96	1,463.00	0.22	0.23	NIL	12,830.00	NIL	28.22	38.00	28.22
868	Bhaisina	BHARATPUR	Weir	Banganga	Banganga	MINOR	27.119786	77.051492	2.59	1676	0.10	0.11	-	4704	-	51	51.00	51
873	Bhonda Gaon	BHARATPUR	Weir	Banganga	Banganga	MINOR	27.017285	77.145832	244.00	2,042.00	0.10	0.10	NIL	427.00	NIL	40.32	67.50	40.32
875	Bhusawar	BHARATPUR	Weir	Banganga	Banganga	MINOR	27.030525	77.065364	3.66	2,408.00	0.31	0.31	NIL	1,602.00	NIL	112.91	57.00	112.91
882	Boraj	BHARATPUR	Weir	Banganga	Banganga	MINOR	27.044016	77.017184	3.74	914.00	0.34	0.34	NIL	1,728.00	NIL	136.29	189.00	136.29
1025	Brijwasi bundh	BHARATPUR	Weir	Banganga	Banganga	Minor	27.125586	77.079259	2.29	1829	0.22	0.22	-	3948	-	202	202.43	202
883	Brilwari	BHARATPUR	Weir	Banganga	Banganga	MINOR	27.129843	77.074370				0.23					38.00	
886	Chak Bholapura	BHARATPUR	Weir	Banganga	Banganga	MINOR	27.063529	77.208595	3.04	914.00	0.03	0.03	NIL	840.00	NIL	40.32	8.00	40.32
901	Garhi	BHARATPUR	Weir	Banganga	Banganga	MINOR	27.027068	77.024577	3.96	945.00	0.11	0.11	NIL	9,115.00	NIL	32.25	57.40	32.25
904	Halena Lower	BHARATPUR	Weir	Banganga	Banganga	MINOR	27.109964	77.170680				0.23					99.90	
905	Halena Upper	BHARATPUR	Weir	Banganga	Banganga	MINOR	27.121509	77.171379				0.34					357.80	
1017	Hewara	BHARATPUR	Weir	Banganga	Banganga	Minor	27.126241	77.028098				0.06					56.00	
912	Jagjivanpur	BHARATPUR	Weir	Banganga	Banganga	MINOR	27.018849	77.128232	3.35	1,067.00	0.05	0.10		500.00		20.16	33.70	20.16
916	Jatpura	BHARATPUR	Weir	Banganga	Banganga	MINOR	27.029842	77.215121	6.85	1,280.00	0.09	0.10		6,058.00		56.45	94.50	56.45
917	Jeewat	BHARATPUR	Weir	Banganga	Banganga	MINOR	27.027025	77.209307	4.47	2,285.00	0.62	0.43		3,920.00		173.79	161.00	173.79
921	Johanpur	BHARATPUR	Weir	Banganga	Banganga	MINOR	27.133786	77.099695				0.49					95.00	
931	Khadraya	BHARATPUR	Weir	Banganga	Banganga	MINOR	27.158370	77.026967	2.40	1280	0.18	0.18	-	1960	-	80	38.00	80
941	Khohri	BHARATPUR	Weir	Banganga	Banganga	MINOR	27.003204	77.224165	3.96	1,676.00	0.17	0.17		560.00		145.16	243.00	145.16
942	Kotapatti	BHARATPUR	Weir	Banganga	Banganga	MINOR	27.005596	77.160413	2.13	1,371.00	0.42	0.43		280.00		161.29	270.00	161.29
947	L uhasa	BHARATPUR	Weir	Banganga	Banganga	MINOR	27.023284	77.237035	3.81	1,828.00	0.01	0.28		360.00		92.74	155.20	92.74
948	Lakhanpur	BHARATPUR	Weir	Banganga	Banganga	MINOR	26.987858	77.188168	2.74	914.00	0.48	0.48		560.00		72.58	121.50	72.58
950	Lalpur	BHARATPUR	Weir	Banganga	Banganga	MINOR	27.054319	77.193014	5.84	4,700.00	7.36	7.36	4.96	15,200.00	4.57	789.00	875.40	789.00
952	Mahammadpur	BHARATPUR	Weir	Banganga	Banganga	MINOR	27.143505	76.995905	2.29	762	0.07	0.07	-	1960	-	44	44.53	44
1033	Mewach	BHARATPUR	Weir	Banganga	Banganga	Minor	27.142848	77.037416				0.18					40.00	
956	Morda	BHARATPUR	Weir	Banganga	Banganga	MINOR	27.012782	77.220127	3.65	1,462.00	0.45	0.20		600.00		120.96	201.60	120.96
958	Muhari	BHARATPUR	Weir	Banganga	Banganga	MINOR	27.042566	77.171727	3.96	3,200.00	0.56	0.56		500.00		153.54	324.00	153.54
1034	Nagla hetram	BHARATPUR	Weir	Banganga	Banganga	Minor	27.161738	77.091168	2.28	914	0.099	0.10	-	5527	-	121	121.21	121
962	Naswara	BHARATPUR	Weir	Banganga	Banganga	MINOR	27.127163	77.185676				0.06					19.00	
964	Navalpura	BHARATPUR	Weir	Banganga	Banganga	MINOR	27.162372	77.012680	4.11	1829	0.15	0.15	-	2240	-	28	28.00	28
965	Naya Barkhera	BHARATPUR	Weir	Banganga	Banganga	MINOR	27.059865	77.219948	3.04	1,219.00	0.15	0.15		560.00		48.38	38.00	48.38
966	Naya Gaon	BHARATPUR	Weir	Banganga	Banganga	MINOR	27.131156	77.192170				0.04					64.80	
969	Newara	BHARATPUR	Weir	Banganga	Banganga	MINOR	27.149584	77.065210	1.77	2134	0.06	0.06	-	3948	-	91	19.00	91
970	Newari	BHARATPUR	Weir	Banganga	Banganga	MINOR	27.140200	77.071505	2.72	1219	0.18	0.18	-	3545	-	40	38.00	40
977	Pali	BHARATPUR	Weir	Banganga	Banganga	MINOR	27.128774	77.160683				0.26					48.00	
985	Raipur	BHARATPUR	Weir	Banganga	Banganga	MINOR	26.995833	77.154722	3.96	1,524.00	0.18	0.18		3,168.00		48.38	48.00	48.38
988	Raniwala	BHARATPUR	Weir	Banganga	Banganga	MINOR	27.001790	77.191123	4.26	2,438.00	0.48	0.48		300.00		133.06	133.60	133.06
1039	Shovana bundh	BHARATPUR	Weir	Banganga	Banganga	Minor	27.020840	77.081969				2.42					161.94	
1014	Sita	BHARATPUR	Weir	Banganga	Banganga	MINOR	26.984065	77.124523				0.64					268.31	
1691	Badriyal	DAUSA	Bandikui	Banganga	Banganga	MINOR	27.070123	76.531300				0.28					69.00	
1697	Dhapawala	DAUSA	Bandikui	Banganga	Banganga	MINOR	27.085319	76.516090	NA	1,213.00	0.20	0.14	NA	22.65	Petakast	NA	40.00	Petakast
1700	Guda mui	DAUSA	Bandikui	Banganga	Banganga	MINOR	27.076589	76.549368	NA	2,743.00	0.30	0.30	NA	NA	Petakast	NA	57.00	Petakast
1715	Redia	DAUSA	Bandikui	Banganga	Banganga	MINOR	27.120506	76.410517	9.45	720.00	5.30	4.56	NA	0.50	14.32	1,336.43	674.50	1,053.00
1716	Reriya	DAUSA	Bandikui	Banganga	Banganga	MINOR	27.118956	76.527608				0.20					38.00	

S. No.	Project Name	District	Block	Basin	Sub-basin	Class	Latitude (DD)	Longitude (DD)	Ht. above Lowest Foundation (m)	Length of Dam (m)	Gross Storage Capacity (Mm^3)	Live Storage Capacity (Mm^3)	Reservoir Area at FRL (km^2)	Design Spilway Capacity (cusecs)	Length of Canal System (km)	Command Area (ha)		
																GCA	CCA	ICA
1	2	3	4	5	6	7	9	10	11	12	13	14	15	16	17	18	19	20
1722	Uparda	DAUSA	Bandikui	Banganga	Banganga	MINOR	27.134685	76.591259	NA	2,225.00	3.80	3.83	NA	NA	Petakast	NA	153.90	Petakast
1723	Vijay Sagar	DAUSA	Bandikui	Banganga	Banganga	MINOR	27.153533	76.565031	NA	1,613.00	1.00	1.02	NA	86.69	Petakast	NA	247.00	Petakast
1693	Bhankari	DAUSA	Dausa	Banganga	Banganga	MINOR	26.930322	76.364740	NA	1,521.00	5.50	0.30	NA	117.69	1.76	NA	40.00	44.53
1695	Chandrana	DAUSA	Dausa	Banganga	Banganga	MINOR	26.978351	76.230713	11.00	3,900.00	4.93	5.49	4.38	1,188.00	12.51	1,124.00	1,012.00	640.00
1699	Gatalao	DAUSA	Dausa	Banganga	Banganga	MINOR	26.866517	76.322492	6.10	1,650.00	5.61	5.60	0.91	97.76	10.00	1,003.23	1,336.00	684.00
1701	Haripur	DAUSA	Dausa	Banganga	Banganga	MINOR	26.926184	76.317535	NA	1,430.00	0.30	0.29	NA	64.07	4.26	NA	72.00	40.48
1705	Kharli	DAUSA	Dausa	Banganga	Banganga	MINOR	26.905109	76.396117				3.20					811.00	
1707	Mahesara	DAUSA	Dausa	Banganga	Banganga	MINOR	26.950452	76.351036	NA	2,403.00	1.50	1.45	NA	150.56	3.03	NA	368.00	79.20
1710	Namt al ao	DAUSA	Dausa	Banganga	Banganga	MINOR	26.866167	76.353263	NA	1,521.00	0.40	0.40	NA	127.40	1.82	NA	99.00	36.43
1714	Ram pura	DAUSA	Dausa	Banganga	Banganga	MINOR	27.024843	76.260474	NA	1,521.00	0.30	0.31	NA	47.22	0.36	NA	40.00	40.00
1720	Sindoli	DAUSA	Dausa	Banganga	Banganga	MINOR	26.982358	76.404560	10.82	1,000.00	2.97	5.77	0.42	89.06	8.83	1,580.00	852.00	826.00
1728	Suraj pura	DAUSA	Dausa	Banganga	Banganga	Minor	26.881420	76.368997	28.50	1,400.00	1.02	1.55	69.68	143.26	4.25	245.00	221.00	145.00
1702	Hudla	DAUSA	Mahwa	Banganga	Banganga	MINOR	27.033333	76.866667	NA	2,160.00	1.20	1.19	NA	109.06	2.74	NA	551.00	105.00
1703	Jagrampura	DAUSA	Mahwa	Banganga	Banganga	MINOR	27.010779	76.925084	4.27	5,020.00	3.83	0.99	7.32	419.09	9.00	1,132.00	991.00	548.00
1706	Kot	DAUSA	Mahwa	Banganga	Banganga	MINOR	27.185716	76.884155	99.97	1,280.00	2.59	2.58	2.87	287.87	12.00	8,200.00	619.00	209.00
1711	Paota	DAUSA	Mahwa	Banganga	Banganga	MINOR	26.953248	76.926774				2.02					482.00	
1712	Pavta	DAUSA	Mahwa	Banganga	Banganga	MINOR	26.963997	76.928908	NA	318.00	0.80	0.79	NA	NA	Petakast	NA	146.00	Petakast
1717	Rondh	DAUSA	Mahwa	Banganga	Banganga	MINOR	27.044933	76.972211	NA	2,678.00	1.00	3.82	NA	NA	Petakast	NA	500.00	Petakast
1692	Bhandari	DAUSA	Sikrai	Banganga	Banganga	MINOR	26.903538	76.559383	7.00	2,290.00	4.56	4.56	NA	246.36	11.11	1,248.00	1,136.00	595.00
1708	Moroli Bund	DAUSA	Sikrai	Banganga	Banganga	MINOR	26.764338	76.506910				0.91					95.00	
1709	Nahar Khora	DAUSA	Sikrai	Banganga	Banganga	MINOR	26.890806	76.752558	NA	761.00	1.20	1.22	NA	92.07	Petakast	NA	263.00	Petakast
1859	Bheru Sagar	JAIPUR	Jamwa Ramgarh	Banganga	Banganga	MINOR	27.054927	76.223818				1.67					400.00	
1864	Birasna	JAIPUR	Jamwa Ramgarh	Banganga	Banganga	MINOR	27.005281	76.187087				4.20					995.60	
1873	Dantli	JAIPUR	Jamwa Ramgarh	Banganga	Banganga	MINOR	27.120990	76.153463				1.30					54.70	
1954	Kharad	JAIPUR	Jamwa Ramgarh	Banganga	Banganga	Minor	27.098518	76.130910				11.80					1,820.00	
1920	Neemla	JAIPUR	Jamwa Ramgarh	Banganga	Banganga	MINOR	27.094375	76.261873				0.28					60.00	
1923	Newar	JAIPUR	Jamwa Ramgarh	Banganga	Banganga	MINOR	26.956184	76.116046				0.50					120.50	
1930	Raiwala	JAIPUR	Jamwa Ramgarh	Banganga	Banganga	MINOR	27.093801	76.220682				1.27					402.00	
1939	Ramyawala	JAIPUR	Jamwa Ramgarh	Banganga	Banganga	MINOR	27.066683	76.258456				0.17					40.00	
1957	Sikka wali	JAIPUR	Jamwa Ramgarh	Banganga	Banganga	Minor	27.043809	76.255620	2.01	2,970.00	0.76	0.68	NIL	280.00	NIL	32.25	68.00	32.25
1911	Mamtori	JAIPUR	Shahpura	Banganga	Banganga	MINOR	27.294219	75.922019				0.65					133.00	
1925	Pando	JAIPUR	Viratnagar	Banganga	Banganga	MINOR	27.374757	76.109070				0.50					89.70	
1942	Sakatpura	JAIPUR	Viratnagar	Banganga	Banganga	MINOR	27.304167	76.125000				0.30					57.00	
1947	Tanku	JAIPUR	Viratnagar	Banganga	Banganga	MINOR	27.334772	76.071717				0.65					133.00	
2463	Singholao	KARAULI	Nadoti	Banganga	Banganga	MINOR	26.737882	76.509006				0.85					133.50	
2424	Anantpura	KARAULI	Todabhim	Banganga	Banganga	MINOR	26.957311	76.880827				0.38					73.00	
	Basin Total										**184.54**	**233.61**				**36,352.14**	**48,554.94**	**22,549.75**
1526	Chakan	BUNDI	Keshoraipatan	Chambal	Chakan	MINOR	25.796526	76.254274				10.11					1,958.00	
1537	Indrani	BUNDI	Keshoraipatan	Chambal	Chakan	MINOR	25.713551	76.182461	9.80	1,661.60	5.57	5.04	172.00	374.97	13.02	866.00	824.00	832.00
2892	Pancholas	SAWAI MADHOPUR	Khandar	Chambal	Chakan	Minor	25.848244	76.281693	8.33	3,784.00	5.77	5.77	NA	260.29	3.00	1,568.00	1,028.00	511.00
3022	Batawadi	TONK	Uniara	Chambal	Chakan	MINOR	25.804765	76.070472	6.70	2,057.90	3.23	2.92	125.00	196.68	Canal 4.5 Minors 1.50	527.43	769.00	527.43
3091	Kumahriya	TONK	Uniara	Chambal	Chakan	MINOR	25.851811	76.130311	5.80	26.40	2.43	2.44	6.14	195.00		1,230.00	458.30	348.18
3183	Rizoda	TONK	Uniara	Chambal	Chakan	Minor	25.922017	76.226514	4.57	1,888.00	0.34	0.34	0.07	1,138.00	Small W.Course	111.33	80.94	48.58
3153	Seedanpur	TONK	Uniara	Chambal	Chakan	MINOR	25.794131	76.149637	6.90	3.29	6.28	5.92	12.29	283.00		1,121.00	1,081.00	728.74
3170	Thikria	TONK	Uniara	Chambal	Chakan	MINOR	25.798578	76.135856	5.70	1.32	3.25	3.68	8.84	5.00	4.80	314.00	755.00	310.12
	Sub Basin Total										**26.87**	**36.22**				**5,737.76**	**6,954.24**	**3,306.05**
1736	Kukpur Tank	DHAULPUR	Dhaulpur	Chambal	Chambal Downstream	MINOR	26.631723	77.798558				0.50					178.50	
1732	Deholi Tank	DHAULPUR	Rajakhera	Chambal	Chambal Downstream	MINOR	26.743574	78.052310				0.42					40.48	
1733	Dharapura Tank	DHAULPUR	Rajakhera	Chambal	Chambal Downstream	MINOR	26.764117	78.026374				0.84					212.55	
1740	Nekhra Tank	DHAULPUR	Rajakhera	Chambal	Chambal Downstream	MINOR	26.713394	77.966399	NA	550.00	0.88	0.74	NA	NA	Bed cultivation	242.80	52.60	36.80
1747	Rajakhera (Bajna)	DHAULPUR	Rajakhera	Chambal	Chambal Downstream	Minor	26.891498	78.168791				1.92					51.00	
2475	Mare ka Kunwa	KARAULI	Sapotra	Chambal	Chambal Downstream	Minor	26.357440	77.299146				1.12					159.81	
2449	Marona	KARAULI	Sapotra	Chambal	Chambal Downstream	MINOR	26.272320	77.231824				0.36					93.00	
2453	Needer	KARAULI	Sapotra	Chambal	Chambal Downstream	MINOR	26.319591	77.190071	17.00			8.82		7,219.00		1,120.00	1,088.00	4,443.00
2458	Rahar Banjara	KARAULI	Sapotra	Chambal	Chambal Downstream	MINOR	26.297721	77.263056				0.29					181.00	
2477	Ranipura	KARAULI	Sapotra	Chambal	Chambal Downstream	Minor	26.290946	77.247675				0.27					150.00	
2481	Dolia	KOTA	Ladpura	Chambal	Chambal Downstream	MINOR	24.942850	75.776058	9.84	431.50	1.11	0.98	17.11 (FTL)	104.71	1.95 Km	132.39	212.00	121.86
2483	Jhalipura	KOTA	Ladpura	Chambal	Chambal Downstream	MINOR	25.182745	75.942962				2.81					402.00	
2485	Lakhawa	KOTA	Ladpura	Chambal	Chambal Downstream	MINOR	25.078884	75.842457		1,170.00	0.72	0.70	N.A.			N.A.	98.00	N.A.
2486	Ranpur	KOTA	Ladpura	Chambal	Chambal Downstream	MINOR	25.033426	75.825813		1,530.00	1.02	0.98	N.A.			N.A.	133.00	N.A.
2851	Deopura Tank	SAWAI MADHOPUR	Khandar	Chambal	Chambal Downstream	MINOR	25.802401	76.346955	19.15	1,058.00	7.66	7.66	181.37	197.08	19.93	2,380.00	1,859.64	1,812.00
	Sub Basin Total										**11.38**	**28.41**				**3,875.19**	**4,911.58**	**6,413.66**
1464	Motipura	BHILWARA	Mandalgarh	Chambal	Chambal Upstream	Minor	25.093858	75.357951				1.10					304.00	

S. No.	Project Name	District	Block	Basin	Sub-basin	Class	Latitude (DD)	Longitude (DD)	Ht. above Lowest Foundation (m)	Length of Dam (m)	Gross Storage Capacity (Mm^3)	Live Storage Capacity (Mm^3)	Reservoir Area at FRL (km^2)	Design Spilway Capacity (cusecs)	Length of Canal System (km)	Command Area (ha)		
																GCA	CCA	ICA
1	2	3	4	5	6	7	9	10	11	12	13	14	15	16	17	18	19	20
1354	Pachanpura	BHILWARA	Mandalgarh	Chambal	Chambal Upstream	MINOR	25.059012	75.317402				9.28					1,479.00	
1480	Resunda	BHILWARA	Mandalgarh	Chambal	Chambal Upstream	Minor	25.070361	75.406907				6.49					130.00	
1528	Dabi	BUNDI	Talera	Chambal	Chambal Upstream	MINOR	25.073423	75.483167		541.00	0.58	1.13	N.A.			N.A.	135.00	N.A.
1533	Ganeshpura	BUNDI	Talera	Chambal	Chambal Upstream	MINOR	25.064990	75.492515		N.A.	0.30	0.30	N.A.			N.A.	47.00	N.A.
1555	Soothara	BUNDI	Talera	Chambal	Chambal Upstream	MINOR	25.089130	75.525662		N.A.	0.34	0.30	N.A.			N.A.	32.00	
1557	Thadi	BUNDI	Talera	Chambal	Chambal Upstream	MINOR	25.089811	75.505427		N.A.	0.85	0.55	N.A.			N.A.	72.00	N.A.
1566	Adia	CHITTAURGARH	Begun	Chambal	Chambal Upstream	MINOR	25.008333	75.044444	7.74	1,491.00	0.82	0.76	31.00	57.00	0.70	317.41	129.00	65.00
1586	Bhanwar Pipla	CHITTAURGARH	Begun	Chambal	Chambal Upstream	MINOR	24.891858	75.059147	17.03	690.00	1.68	1.55	0.04	232.10	7.56	423.00	392.00	333.00
1684	Dhandra	CHITTAURGARH	Begun	Chambal	Chambal Upstream	Minor	24.943753	75.078020				0.35					74.84	
1596	Dorlai	CHITTAURGARH	Begun	Chambal	Chambal Upstream	MINOR	24.923282	74.990537	17.20	2,999.00	8.50	8.27	0.20	657.00	10.50	1,837.00	1,571.00	1,174.00
1686	Jalsagar	CHITTAURGARH	Begun	Chambal	Chambal Upstream	Minor	24.923148	74.990617				1.40					270.85	
1687	Kadmali	CHITTAURGARH	Begun	Chambal	Chambal Upstream	Minor	24.960289	74.901399	11.54	270.00	0.77	0.67	0.04	266.00	2.89	155.00	144.00	130.00
1608	Kaladeh	CHITTAURGARH	Begun	Chambal	Chambal Upstream	MINOR	24.944949	75.040238	14.75	643.00	2.12	1.75	0.06	224.00	2.52	508.00	429.00	301.00
1643	Rajgarh	CHITTAURGARH	Begun	Chambal	Chambal Upstream	MINOR	24.939061	75.010962	7.22	1,913.00	3.03	2.78	0.11	152.00	2.40	608.00	347.00	265.00
1592	Dasunda	CHITTAURGARH	Bhainsrorgarh	Chambal	Chambal Upstream	MINOR	25.009171	75.437175				0.51					130.00	
1624	Mansarowar	CHITTAURGARH	Bhainsrorgarh	Chambal	Chambal Upstream	MINOR	24.928816	75.516022	4.95	624.00	0.69	0.65	37.00	57.00	1.71	189.47	185.00	92.00
1632	Nahargarh	CHITTAURGARH	Bhainsrorgarh	Chambal	Chambal Upstream	MINOR	24.998490	75.372971	7.62	937.00	0.85	0.79	52.00	73.00	1.89	278.95	227.00	91.00
1661	Shripura	CHITTAURGARH	Bhainsrorgarh	Chambal	Chambal Upstream	MINOR	24.966695	75.466087				0.59					141.00	
1665	Umarcha	CHITTAURGARH	Bhainsrorgarh	Chambal	Chambal Upstream	MINOR	24.914025	75.344584	3.43	579.00	0.85	0.79	33.00	3.00	2.00	506.07	253.00	113.00
1682	Bhawalia	CHITTAURGARH	Nimbahera	Chambal	Chambal Upstream	Minor	24.754690	74.925716	12.97	232.00	2.56	2.31		453.06		592.00	533.30	534.00
1689	Sarsi ka Naka	CHITTAURGARH	Nimbahera	Chambal	Chambal Upstream	Minor	24.657911	74.921037	9.86	895.00	1.51	1.35		119.29	NA	444.00	383.00	383.00
2478	Bora bas	KOTA	Ladpura	Chambal	Chambal Upstream	MINOR	25.027077	75.692802				0.51					88.00	
1683	Chacha kheri	PRATAPGARH	Arnod	Chambal	Chambal Upstream	Minor	23.912791	74.854803	10.54	910.00	1.66	1.48		172.00	NA	450.00	277.00	318.00
2729	Bajrang garh	PRATAPGARH	Pratapgarh	Chambal	Chambal Upstream	Minor	23.990044	74.868940	10.41	1,230.00	2.01	1.84		286.72		347.00	264.00	264.00
2705	Bardia	PRATAPGARH	Pratapgarh	Chambal	Chambal Upstream	MINOR	24.221792	74.865630	7.16	350.60	1.98	1.81		196.00	3.30	445.00	735.00	207.00
2712	Gadola	PRATAPGARH	Pratapgarh	Chambal	Chambal Upstream	MINOR	24.123258	74.834311	9.75	1,707.00	5.07	4.98		398.63	7.30	1,222.00	1,098.00	713.00
2730	Machalana	PRATAPGARH	Pratapgarh	Chambal	Chambal Upstream	Minor	24.038008	74.931717	17.41	330.00	4.20	4.11		332.50	NA	735.00	588.00	597.00
	Sub Basin Total										**40.38**	**58.40**				**9,057.90**	**10,458.99**	**5,580.00**
634	Anta Lift	BARAN	Antah	Chambal	Kali Sindh	MINOR	25.167540	76.300271	4.75	1,200.00	0.76	11.11	32.00	168.57	0.60 Km	202.43	1,587.00	103.23
644	Chhatrapura	BARAN	Antah	Chambal	Kali Sindh	MINOR	25.272396	76.370839				1.71					244.00	
659	Pachel Lift	BARAN	Antah	Chambal	Kali Sindh	MINOR	25.213471	76.403507				2.27					324.00	
669	Sorkhand Lift	BARAN	Antah	Chambal	Kali Sindh	MINOR	25.189346	76.400335				7.97					1,138.00	
632	Akawad Lift	BARAN	Atru	Chambal	Kali Sindh	MINOR	24.660221	76.495490	3.50	530.00	4.08	0.53	Nil	14,400.00		-	494.00	395.00
651	Kachri Lift	BARAN	Atru	Chambal	Kali Sindh	MINOR	24.859072	76.613005				12.52					1,788.00	
675	Mothpur	BARAN	Atru	Chambal	Kali Sindh	Minor	24.739269	76.623037		1,590.00	0.14	0.14	N.A.			N.A.	40.80	N.A.
656	Motipura	BARAN	Atru	Chambal	Kali Sindh	MINOR	24.713615	76.654482				0.14					40.00	
633	Amar	BARAN	Chhipabarod	Chambal	Kali Sindh	MINOR	24.466902	76.644941				1.07					153.00	
650	Kachnariya Khurd	BARAN	Chhipabarod	Chambal	Kali Sindh	MINOR	24.430926	76.734545				2.71					322.00	
2167	Jarawatpura	JHALAWAR	Bakani	Chambal	Kali Sindh	Minor	24.259015	76.510454	10.35	1,050.00	2.83	2.50		288.68		375.00	374.73	354.66
2143	Modi	JHALAWAR	Bakani	Chambal	Kali Sindh	MINOR	24.259541	76.281530	12.62	685.00	1.44	1.33		97.85		268.82	257.89	247.41
2145	Molakia	JHALAWAR	Bakani	Chambal	Kali Sindh	MINOR	24.341219	76.305545	7.01	548.78	0.71	0.62				133.00	121.40	89.00
2152	Rajpura	JHALAWAR	Bakani	Chambal	Kali Sindh	MINOR	24.400000	76.262500	7.62	1,143.00	1.96	1.90		160.18		339.00	309.58	272.00
2154	Rijoda	JHALAWAR	Bakani	Chambal	Kali Sindh	MINOR	24.444969	76.259691		685.00	0.52	0.52	N.A.			116.60	114.00	66.60
2170	Talawda	JHALAWAR	Bakani	Chambal	Kali Sindh	Minor	24.205370	76.520098	11.50	405.00	0.74	0.74		71.37		180.56	140.56	128.00
2165	Benaiga	JHALAWAR	Dag	Chambal	Kali Sindh	Minor	24.067383	75.882114				2.39					440.00	
2121	Bisthunia	JHALAWAR	Dag	Chambal	Kali Sindh	MINOR	24.138062	75.833526	15.32	570.00	1.66	1.56				379.00	311.66	224.00
2137	Kyasara	JHALAWAR	Dag	Chambal	Kali Sindh	MINOR	23.981390	75.871822		225.70	0.37	0.37	N.A.			134.00	107.00	40.00
2139	Madhvi	JHALAWAR	Dag	Chambal	Kali Sindh	MINOR	24.000565	75.831103	11.60	240.00	2.79	2.46		196.90		220.82	198.00	198.04
2151	Pondla	JHALAWAR	Dag	Chambal	Kali Sindh	MINOR	24.008087	75.903589	9.90	405.00	1.50	1.37		112.84		258.00	246.85	195.14
2155	Salriya	JHALAWAR	Dag	Chambal	Kali Sindh	MINOR	24.068671	75.857069	8.03	720.00	0.50	0.48		46.61		103.20	103.20	94.00
2160	Singhpur	JHALAWAR	Dag	Chambal	Kali Sindh	MINOR	24.144097	75.765208	9.41	525.00	1.16	1.08		82.41		201.30	201.30	163.06
2163	Vinayaka	JHALAWAR	Dag	Chambal	Kali Sindh	MINOR	24.072951	75.881482				2.53					439.88	
2119	Bhimli Pickup weir	JHALAWAR	Jhalrapatan	Chambal	Kali Sindh	MINOR	24.447105	76.366815	6.00	61.00		2.41				358.00	325.77	269.00
2122	Borda	JHALAWAR	Jhalrapatan	Chambal	Kali Sindh	MINOR	24.425565	76.210077	11.50	1,110.00	2.58	2.32		240.05		486.00	413.99	328.00
2123	Chandra Sarovar	JHALAWAR	Jhalrapatan	Chambal	Kali Sindh	MINOR	24.584001	76.154069		45.73	1.70	1.07	N.A.			N.A.	154.00	123.00
2125	Durgapura	JHALAWAR	Jhalrapatan	Chambal	Kali Sindh	MINOR	24.625991	76.145791		975.61	1.39	1.39	N.A.			220.00	201.00	
2126	Ganeshpura	JHALAWAR	Jhalrapatan	Chambal	Kali Sindh	MINOR	24.497704	76.411326	15.00	245.42	3.85	3.56		201.72		713.00	585.57	508.00
2127	Gordhanpura	JHALAWAR	Jhalrapatan	Chambal	Kali Sindh	MINOR	24.568192	76.264020	10.36	243.90	2.58	2.36					418.84	269.00
2130	Juna Khera	JHALAWAR	Jhalrapatan	Chambal	Kali Sindh	MINOR	24.452800	76.296009		388.72	0.39	0.39	N.A.			100.00	80.00	56.00
2132	Kadila	JHALAWAR	Jhalrapatan	Chambal	Kali Sindh	MINOR	24.623691	76.215742	9.14	45.73	4.08	3.95				378.00	343.98	275.00
2136	Kishan Sagar	JHALAWAR	Jhalrapatan	Chambal	Kali Sindh	MINOR	24.624573	76.114476		1,280.48	1.59	1.59	N.A.			N.A.	189.00	150.00
2138	Madan Sagar	JHALAWAR	Jhalrapatan	Chambal	Kali Sindh	MINOR	24.542097	76.171205		213.41	1.98	1.70	N.A.			N.A.	243.00	160.00
2140	Mahodia	JHALAWAR	Jhalrapatan	Chambal	Kali Sindh	MINOR	24.352262	75.764857				0.80					116.00	
2141	Mandawar	JHALAWAR	Jhalrapatan	Chambal	Kali Sindh	MINOR	24.585766	76.240782		213.41	1.44	1.44	N.A.			N.A.	238.00	190.00
2142	Mathniya	JHALAWAR	Jhalrapatan	Chambal	Kali Sindh	MINOR	24.315451	75.833016	12.06	645.00	1.76	1.75		148.23		365.00	334.00	246.00
2144	Mogra	JHALAWAR	Jhalrapatan	Chambal	Kali Sindh	MINOR	24.350833	75.898056	8.73	1,140.00	3.18	2.61		574.51		480.86	446.00	364.00
2146	Mundliya kheri	JHALAWAR	Jhalrapatan	Chambal	Kali Sindh	MINOR	24.515443	76.140754				4.36					590.83	

S. No.	Project Name	District	Block	Basin	Sub-basin	Class	Latitude (DD)	Longitude (DD)	Ht. above Lowest Foundation (m)	Length of Dam (m)	Gross Storage Capacity (Mm^3)	Live Storage Capacity (Mm^3)	Reservoir Area at FRL (km^2)	Design Spilway Capacity (cusecs)	Length of Canal System (km)	Command Area (ha)		
																GCA	CCA	ICA
1	2	3	4	5	6	7	9	10	11	12	13	14	15	16	17	18	19	20
2147	Naka Sama	JHALAWAR	Jhalrapatan	Chambal	Kali Sindh	MINOR	24.331285	75.822749		502.00	0.66	0.66	N.A.			160.00	129.00	88.00
2148	Narayanpura	JHALAWAR	Jhalrapatan	Chambal	Kali Sindh	MINOR	24.676446	76.134049	9.21	600.00	0.47	0.42		61.79		101.17	85.00	85.00
2149	Nimoda	JHALAWAR	Jhalrapatan	Chambal	Kali Sindh	MINOR	24.526574	76.114002		720.00	0.88	0.88	N.A.			210.00	189.00	113.00
2153	Ram Niwas Ghatod	JHALAWAR	Jhalrapatan	Chambal	Kali Sindh	MINOR	24.473715	75.925140		640.24	0.28	0.28	N.A.			63.00	56.00	36.00
2168	Salkhera	JHALAWAR	Jhalrapatan	Chambal	Kali Sindh	Minor	24.441862	76.169681	12.14	202.45	0.57	0.57		214.20		170.00	136.00	106.26
2156	Sarankheri	JHALAWAR	Jhalrapatan	Chambal	Kali Sindh	MINOR	24.469683	76.145218	16.00	960.00	6.23	5.72		330.00		1,444.00	1,376.71	827.00
2161	Tai ka Khera	JHALAWAR	Jhalrapatan	Chambal	Kali Sindh	MINOR	24.418273	75.913786	10.60	1,020.00	1.60	1.53		109.60		291.00	279.25	227.00
2120	Bilasra	JHALAWAR	Khanpur	Chambal	Kali Sindh	MINOR	24.817703	76.418852		1,646.00	0.73	0.73	N.A.			N.A.	69.00	103.00
2128	Harigarh	JHALAWAR	Khanpur	Chambal	Kali Sindh	MINOR	24.703363	76.239102	8.70	746.00	1.26	1.01		296.50		264.00	246.15	244.00
2129	Jolpa	JHALAWAR	Khanpur	Chambal	Kali Sindh	MINOR	24.851601	76.360884		2,012.00	1.29	1.04	N.A.			N.A.	162.00	134.50
2135	Kanwarpura	JHALAWAR	Khanpur	Chambal	Kali Sindh	MINOR	24.815293	76.382165				1.50					244.00	
2158	Sarola	JHALAWAR	Khanpur	Chambal	Kali Sindh	MINOR	24.612059	76.411197	11.50	1,857.30	4.70	4.22		250.77		1,020.00	927.52	477.00
2162	Thikriya	JHALAWAR	Khanpur	Chambal	Kali Sindh	MINOR	24.746871	76.361314	10.25	420.00	1.91	1.79		131.27		401.10	369.85	316.00
2166	Chajliya	JHALAWAR	Manohar Thana	Chambal	Kali Sindh	Minor	24.312022	76.658378	10.51	1,215.00	2.19	1.94		159.92		457.00	408.00	600.00
2131	Juna Pani	JHALAWAR	Manohar Thana	Chambal	Kali Sindh	MINOR	24.282538	76.812623	12.00	423.00	0.62	0.56		61.84		123.10	119.00	118.62
2133	Kalikhar	JHALAWAR	Manohar Thana	Chambal	Kali Sindh	MINOR	24.233888	76.840181	18.56	2,370.00	14.65	10.86		1,222.99		1,727.00	1,922.00	1,639.00
2134	Kanwariya kheri	JHALAWAR	Manohar Thana	Chambal	Kali Sindh	MINOR	24.186231	76.742739	11.15	285.00	0.47	0.45		37.43		107.00	96.00	96.00
2150	Parliya	JHALAWAR	Manohar Thana	Chambal	Kali Sindh	MINOR	24.430661	76.458576				0.58					101.00	
2164	Amin Kheri	JHALAWAR	Pirawa	Chambal	Kali Sindh	Minor	24.189199	75.914827		411.48	0.69	0.64	N.A.			132.00	119.00	62.00
2118	Banskheri	JHALAWAR	Pirawa	Chambal	Kali Sindh	MINOR	24.115517	75.987307				0.89					189.00	
2124	Dobra	JHALAWAR	Pirawa	Chambal	Kali Sindh	MINOR	24.351700	76.130134	11.72	540.00	0.80	1.05		69.61		126.32	214.00	119.43
2157	Sarkheri	JHALAWAR	Pirawa	Chambal	Kali Sindh	MINOR	24.088100	76.073227	9.90	800.00	0.54	0.51		68.88		114.57	112.55	100.00
2169	Sawant Khera	JHALAWAR	Pirawa	Chambal	Kali Sindh	Minor	24.085367	76.034733				2.09					240.00	
2159	Semli Chauhan	JHALAWAR	Pirawa	Chambal	Kali Sindh	MINOR	24.071882	75.982486	10.07	930.00	1.07	0.98		65.03		220.00	213.00	192.00
2484	Khati khera	KOTA	Sangod	Chambal	Kali Sindh	MINOR	25.062219	76.117385				0.99					71.00	
2479	Choma	KOTA	Sultanpura	Chambal	Kali Sindh	MINOR	25.090338	76.114329		928.00	0.78	0.70	N.A.			N.A.	106.00	N.A.
2480	Dahra	KOTA	Sultanpura	Chambal	Kali Sindh	MINOR	25.148329	76.087424	4.70	1,860.00	1.80	1.72	Nil	166.00	3.30 Km	333.00	306.00	316.00
2482	Girdhar pura	KOTA	Sultanpura	Chambal	Kali Sindh	MINOR	25.074895	76.124410				0.99					99.00	
	Sub Basin Total										**91.87**	**137.01**				**13,476.85**	**22,761.86**	**11,507.95**
636	Bagdev	BARAN	Shahbad	Chambal	Kunu	MINOR	25.196801	77.407211				1.31					258.00	
638	Bedara	BARAN	Shahbad	Chambal	Kunu	MINOR	25.263471	77.179759		365.00	4.00	0.53	Nil	58.69		126.58	118.00	-
673	Chak Shahbad Lift	BARAN	Shahbad	Chambal	Kunu	Minor	25.246781	77.173556				2.23					462.00	
674	Khiriya	BARAN	Shahbad	Chambal	Kunu	MINOR	25.233760	77.367958	6.00	1,500.00	2.36	0.67	89.40	7.20		190.00	87.00	154.80
667	Sirsipura	BARAN	Shahbad	Chambal	Kunu	MINOR	25.275573	77.346422		1,311.00	1.45	1.27	N.A.			N.A.	182.00	N.A.
	Sub Basin Total										**7.81**	**6.01**				**316.58**	**1,107.00**	**154.80**
1482	Bheru Sagar Media	BHILWARA	Jahazpur	Chambal	Mej	Minor	25.544644	75.350686	8.96	640.00	0.64	1.77	2.60	3,950.00	2.49	101.92	93.00	84.00
1118	Bijetha I	BHILWARA	Jahazpur	Chambal	Mej	MINOR	25.595068	75.385933				0.71					202.00	
1122	Biletha	BHILWARA	Jahazpur	Chambal	Mej	MINOR	25.608718	75.386971				0.45					88.00	
1077	Daigosula	BHILWARA	Jahazpur	Chambal	Mej	MINOR	25.495768	75.310332				0.46					113.00	
1483	Dev Narayan Sagar Samelia	BHILWARA	Jahazpur	Chambal	Mej	Minor	25.418583	75.180172	11.23	1,105.00	1.40	1.27	8.90	16,002.00	2.40	222.27	202.00	182.59
1232	Itunda	BHILWARA	Jahazpur	Chambal	Mej	MINOR	25.627104	75.397187				0.51					97.00	
1282	Kheruna	BHILWARA	Jahazpur	Chambal	Mej	MINOR	25.467261	75.280756				0.59					209.00	
1337	Navratan Sagar	BHILWARA	Jahazpur	Chambal	Mej	MINOR	25.525585	75.342271	12.50	1,158.00	2.26	2.04	7.90	13,707.00	4.98	-	392.00	278.00
1364	Patiyal	BHILWARA	Jahazpur	Chambal	Mej	MINOR	25.363889	75.245833				1.53					258.00	
1365	Penghatia	BHILWARA	Jahazpur	Chambal	Mej	MINOR	25.657999	75.395733				1.13					249.00	
1370	Pitha Ka Mand	BHILWARA	Jahazpur	Chambal	Mej	MINOR	25.372134	75.223919				1.01					169.00	
1386	Ratangarh	BHILWARA	Jahazpur	Chambal	Mej	MINOR	25.410723	75.243325				0.40					114.00	
1414	Shambhu Sagar Talab	BHILWARA	Jahazpur	Chambal	Mej	MINOR	25.559503	75.333953				0.38					72.00	
1467	Bajrang Sagar Butti	BHILWARA	Mandalgarh	Chambal	Mej	Minor	25.122084	75.354986				0.13					41.00	
1121	Bikran	BHILWARA	Mandalgarh	Chambal	Mej	MINOR	25.303168	75.243286				0.31					66.00	
1479	Dhobi ghatta	BHILWARA	Mandalgarh	Chambal	Mej	Minor	25.305273	75.243517	NA	1,030.00	16.96	0.32	NA	2,334.00	0.90	61.00	47.00	
1252	Judeka Naka	BHILWARA	Mandalgarh	Chambal	Mej	MINOR	25.320807	75.331658				1.72					355.00	
1256	Kabria	BHILWARA	Mandalgarh	Chambal	Mej	MINOR	25.270833	75.386111				0.53					70.00	
1314	Mandol	BHILWARA	Mandalgarh	Chambal	Mej	MINOR	25.170371	75.362100				5.12					902.00	
1332	Nathji-ka-Khera	BHILWARA	Mandalgarh	Chambal	Mej	MINOR	25.210832	75.298582				0.42					64.00	
1412	Shakargarh	BHILWARA	Mandalgarh	Chambal	Mej	MINOR	25.251998	75.293609	11.13	2,156.00	4.31	3.81	-	2,500.00	7.44	-	829.00	747.00
1417	Shiv Sagar B.M.	BHILWARA	Mandalgarh	Chambal	Mej	MINOR	25.202364	75.364135				2.05					421.00	
1481	Sushila Sagar	BHILWARA	Mandalgarh	Chambal	Mej	Minor	25.309192	75.317585	NA	NA	1.43	1.98	NA	121.29	41.20	738.32	295.00	611.08
1541	Lamba Khoh	BUNDI	Bundi	Chambal	Mej	MINOR	25.175176	75.513641				0.23					40.00	
1547	Palka Upper	BUNDI	Bundi	Chambal	Mej	MINOR	25.140503	75.527493		N.A.	0.23	0.16	N.A.			N.A.	24.00	N.A.
1548	Pallka Lower	BUNDI	Bundi	Chambal	Mej	MINOR	25.165044	75.584105				0.16					32.00	
1554	Shambhupura	BUNDI	Bundi	Chambal	Mej	MINOR	25.448259	75.730812		1,890.00	2.65	2.63	N.A.			N.A.	93.00	N.A.
1518	Amargarh Kalichat	BUNDI	Hindoli	Chambal	Mej	MINOR	25.342283	75.335509				0.85					160.00	
1521	Bankiya Khal	BUNDI	Hindoli	Chambal	Mej	MINOR	25.542780	75.392355	7.60	400.20	2.19	2.89	121.18	15.62	3.66	497.34	402.00	377.86
1523	Basani	BUNDI	Hindoli	Chambal	Mej	MINOR	25.690437	75.427490		N.A.	0.18	0.15	N.A.			N.A.	80.00	N.A.
1524	Batwari	BUNDI	Hindoli	Chambal	Mej	MINOR	25.661553	75.448897				3.23					307.57	

S. No.	Project Name	District	Block	Basin	Sub-basin	Class	Latitude (DD)	Longitude (DD)	Ht. above Lowest Foundation (m)	Length of Dam (m)	Gross Storage Capacity (Mm^3)	Live Storage Capacity (Mm^3)	Reservoir Area at FRL (km^2)	Design Spilway Capacity (cusecs)	Length of Canal System (km)	Command Area (ha)		
																GCA	CCA	ICA
1	2	3	4	5	6	7	9	10	11	12	13	14	15	16	17	18	19	20
1527	Chanda KaTalab	BUNDI	Hindoli	Chambal	Mej	MINOR	25.594333	75.423301	9.60	855.00	3.40	3.11	213.00	754.00	Canal 4.2 Minors 4.32	583.00	484.00	484.00
1534	Gar Gurjaniya	BUNDI	Hindoli	Chambal	Mej	MINOR	25.442020	75.344046				1.07					105.00	
1535	Gudha Gopalpura	BUNDI	Hindoli	Chambal	Mej	MINOR	25.569246	75.402047		397.55	3.38	3.19	N.A.			N.A.	280.00	280.00
1536	Hindoli	BUNDI	Hindoli	Chambal	Mej	MINOR	25.595475	75.581757		N.A.	1.02	0.67	N.A.			N.A.	243.00	N.A.
1542	Mandi	BUNDI	Hindoli	Chambal	Mej	MINOR	25.651847	75.583963	7.80	780.00	2.73	2.43	96.88	350.40	6.75	731.00	579.00	579.00
1543	Mardia	BUNDI	Hindoli	Chambal	Mej	MINOR	25.386415	75.327122	9.50	435.00	3.96	3.52	96.00	138.38	3.30	804.66	555.00	792.00
1565	Motipura	BUNDI	Hindoli	Chambal	Mej	Minor	25.611985	75.469289	10.67	870.00	3.76	3.56	118.00	373.54	Canal 4.2 Minors 1.2	578.59	497.00	477.43
1563	Narain khera	BUNDI	Hindoli	Chambal	Mej	Minor	25.470684	75.498877				2.40					309.00	
1544	Narainpura	BUNDI	Hindoli	Chambal	Mej	MINOR	25.457868	75.485122	16.60	285.00	2.40	2.15	39.00	296.59	3.81	392.68	387.00	352.50
1545	Net	BUNDI	Hindoli	Chambal	Mej	MINOR	25.555560	75.448188		N.A.	0.63	0.23	N.A.			N.A.	51.80	N.A.
1549	Pech Ki Baori	BUNDI	Hindoli	Chambal	Mej	MINOR	25.640185	75.445307	8.20	883.87	5.62	5.60	159.00	378.06	22.20	1,725.00	946.00	1,037.00
1550	Ram Nagar	BUNDI	Hindoli	Chambal	Mej	MINOR	25.523611	75.568518		N.A.	0.80	0.75	N.A.			N.A.	40.00	N.A.
1551	Roon ka khal	BUNDI	Hindoli	Chambal	Mej	MINOR	25.339470	75.422829		503.00	1.39	1.32	N.A.			N.A.	190.00	N.A.
1552	Roonija	BUNDI	Hindoli	Chambal	Mej	MINOR	25.723310	75.688854	11.50	317.00	5.23	5.00	NA	297.15	6.90	1,693.00	1,205.00	1,200.00
1553	Salwaliya	BUNDI	Hindoli	Chambal	Mej	MINOR	25.553964	75.426270		230.00	1.64	1.64	N.A.			N.A.	213.00	N.A.
1558	Vijay Garh II	BUNDI	Hindoli	Chambal	Mej	MINOR	25.513482	75.411651		N.A.	0.25	0.45	N.A.			N.A.	57.00	N.A.
1559	Vijay Garh	BUNDI	Hindoli	Chambal	Mej	MINOR	25.516616	75.418295		N.A.	0.15	0.15	N.A.			N.A.	57.00	N.A.
1560	Bore ka khal	BUNDI	Keshoraipatan	Chambal	Mej	Minor	25.439474	76.040164		N.A.	0.20	0.26	N.A.			N.A.	40.00	N.A.
1519	Anna Purna	BUNDI	Nainwa	Chambal	Mej	MINOR	25.738188	75.734153				0.82					160.00	
1520	Bankiya ka Naya Gaon	BUNDI	Nainwa	Chambal	Mej	MINOR	25.675557	75.924815				0.65					180.00	
1522	Bansoli	BUNDI	Nainwa	Chambal	Mej	MINOR	25.714460	75.984894	6.90	2,454.30	3.73	2.88	165.00	211.66	3.81	1,404.00	931.00	1,012.10
1529	Dei Ganga Sagar	BUNDI	Nainwa	Chambal	Mej	MINOR	25.698855	75.942355		1,780.00	1.29	1.21	N.A.			N.A.	203.00	N.A.
1530	Dhandun	BUNDI	Nainwa	Chambal	Mej	MINOR	25.653396	76.017783		645.00	0.99	1.61	N.A.			N.A.	228.00	N.A.
1561	Jet Sagar	BUNDI	Nainwa	Chambal	Mej	Minor	25.619421	75.976829	8.60	182.00	1.00	1.01	48.00	216.93			104.00	
1539	Khanpura	BUNDI	Nainwa	Chambal	Mej	MINOR	25.763128	75.847476		N.A.	0.45	0.28	N.A.			N.A.	40.00	N.A.
1540	Khodi	BUNDI	Nainwa	Chambal	Mej	MINOR	25.758719	75.781670		762.00	1.05	1.00	N.A.			N.A.	192.00	N.A.
1562	Machhali	BUNDI	Nainwa	Chambal	Mej	Minor	25.685231	76.035403	7.75	3,517.00	5.00	5.00	275.00	690.00	7.68	983.00	796.00	796.00
1546	Paibalapura	BUNDI	Nainwa	Chambal	Mej	MINOR	25.707879	75.881206	14.53	3,341.00	12.97	10.08	0.19	611.00	5.19	2,490.00	1,900.00	1,899.00
1564	Sheopur Mahadev	BUNDI	Nainwa	Chambal	Mej	Minor	25.652148	76.047399		N.A.	0.20	0.20	N.A.			N.A.	40.00	N.A.
1556	Talwas	BUNDI	Nainwa	Chambal	Mej	MINOR	25.621272	76.038666		640.00	0.95	1.57	N.A.			N.A.	222.00	N.A.
1525	Bhawanipura	BUNDI	Talera	Chambal	Mej	MINOR	25.099555	75.576286		N.A.	0.36	0.36	N.A.			N.A.	36.00	N.A.
1531	Dhaneshwar	BUNDI	Talera	Chambal	Mej	MINOR	25.079067	75.591848		N.A.	0.34	0.30	N.A.			N.A.	48.00	N.A.
1532	Dora	BUNDI	Talera	Chambal	Mej	MINOR	25.186457	75.637681		N.A.	0.20	0.20	N.A.			N.A.	32.00	N.A.
1538	Kanwarpura	BUNDI	Talera	Chambal	Mej	MINOR	25.118677	75.578903		N.A.	0.60	0.50	N.A.			N.A.	40.00	N.A.
3128	Rajkalan Anwa	TONK	Deoli	Chambal	Mej	MINOR	25.796387	75.616767	4.42	365.00	0.34	0.34	0.08	1,260.00	1.37	121.46	78.00	48.58
3129	Rajkot	TONK	Deoli	Chambal	Mej	MINOR	25.728192	75.574329	4.50	2,377.00	0.50	0.50	0.11	2,520.00	7.45	188.66	132.00	70.44
3149	Sardarpur	TONK	Deoli	Chambal	Mej	MINOR	25.767314	75.613834			1.41	1.41					242.00	
3160	Sitapur	TONK	Deoli	Chambal	Mej	MINOR	25.782436	75.567698	5.18	511.00	0.40	0.40	0.08	2,548.00		141.70	91.00	56.68
3172	Titora	TONK	Deoli	Chambal	Mej	MINOR	25.737797	75.580839				1.23					227.00	
	Sub Basin Total										**100.59**	**107.99**				**13,457.60**	**18,647.37**	**11,365.26**
642	Budh Sagar	BARAN	Atru	Chambal	Parwati	MINOR	24.867882	76.674811		N.A.	0.88	0.88	N.A.			N.A.	130.00	N.A.
664	Ratanpura	BARAN	Atru	Chambal	Parwati	MINOR	24.888529	76.676573				0.52					105.00	
640	Bhatwara	BARAN	Baran	Chambal	Parwati	MINOR	25.104667	76.455488				1.44					207.00	
645	Daulat pura	BARAN	Baran	Chambal	Parwati	MINOR	25.046111	76.516667		1,800.00	1.00	1.00	N.A.			N.A.	190.00	N.A.
647	Haripura	BARAN	Baran	Chambal	Parwati	MINOR	25.094962	76.423590				0.84					120.00	
668	Sorkhand	BARAN	Baran	Chambal	Parwati	MINOR	25.162254	76.464141		1,290.00	1.28	1.28	N.A.			N.A.	240.00	N.A.
649	Hindlot	BARAN	Chhabra	Chambal	Parwati	MINOR	24.588899	76.939258	19.70	1,590.00	28.88	13.92	387.88	1,261.00		Dedicated to RVUNL	1,973.00	
658	Pach kui	BARAN	Chhipabarod	Chambal	Parwati	MINOR	24.648746	76.663706		564.00	0.63	0.63	N.A.			N.A.	102.00	N.A.
661	Phaliya	BARAN	Chhipabarod	Chambal	Parwati	MINOR	24.688091	76.616866	9.05	448.00	5.33	1.61	52.00	122.54		438.00	343.00	-
671	Utawali	BARAN	Chhipabarod	Chambal	Parwati	MINOR	24.673888	76.740725	8.38	1,440.00	0.62	4.45	94.73	230.78		856.00	710.00	638.00
635	Badipura	BARAN	Kishanganj	Chambal	Parwati	MINOR	24.873525	76.884681				3.73					656.00	
639	Bhanwar garh	BARAN	Kishanganj	Chambal	Parwati	MINOR	25.080103	76.798998				1.41					210.00	
641	Bilas garh	BARAN	Kishanganj	Chambal	Parwati	MINOR	25.047884	76.829439				2.19					288.00	
643	Chattarpura	BARAN	Kishanganj	Chambal	Parwati	MINOR	24.910515	76.857671	6.80	3,360.00	3.26	5.74	-	285.26		1,108.00	1,012.00	940.00
646	Eklera Sagar	BARAN	Kishanganj	Chambal	Parwati	MINOR	25.136010	76.670816	6.18	2,396.00	6.16	9.74	-	255.16		2,070.00	1,858.00	1,719.00
652	Kalisot	BARAN	Kishanganj	Chambal	Parwati	MINOR	25.002862	76.811122	7.78	1,687.00	2.50	7.02	-	206.02		915.00	875.00	810.00
655	Mahodari	BARAN	Kishanganj	Chambal	Parwati	MINOR	24.879860	76.788726	8.79	2,941.00	1.50	2.20	-	136.70		498.00	421.00	252.00
657	Nahar Garh	BARAN	Kishanganj	Chambal	Parwati	MINOR	24.935875	76.845514	4.94	1,080.00	1.80	2.23	Nil	49.00		434.00	319.00	230.00
660	Phaldi	BARAN	Kishanganj	Chambal	Parwati	MINOR	25.104710	76.648482		N.A.	0.42	0.35	N.A.			N.A.	51.00	N.A.
672	Sitabari	BARAN	Kishanganj	Chambal	Parwati	Saran	25.165088	76.734513				12.25					1,101.00	
670	Sunda	BARAN	Kishanganj	Chambal	Parwati	MINOR	25.170904	76.848801				0.69					99.00	
637	Balda	BARAN	Shahbad	Chambal	Parwati	MINOR	25.106791	76.887039				1.18					169.00	
648	Hatwari	BARAN	Shahbad	Chambal	Parwati	MINOR	25.106026	76.911076		2,374.00	0.76	0.76	N.A.			N.A.	108.00	N.A.
653	Kelwara	BARAN	Shahbad	Chambal	Parwati	MINOR	25.134723	76.875913		750.00	0.36	0.36	N.A.			N.A.	120.00	N.A.

S. No.	Project Name	District	Block	Basin	Sub-basin	Class	Latitude (DD)	Longitude (DD)	Ht. above Lowest Foundation (m)	Length of Dam (m)	Gross Storage Capacity (Mm^3)	Live Storage Capacity (Mm^3)	Reservoir Area at FRL (km^2)	Design Spilway Capacity (cusecs)	Length of Canal System (km)	Command Area (ha)		
																GCA	CCA	ICA
1	2	3	4	5	6	7	9	10	11	12	13	14	15	16	17	18	19	20
654	Khatka	BARAN	Shahbad	Chambal	Parwati	MINOR	25.202460	77.033214	11.48	1,966.00	4.78	3.01	122.46	242.20		729.00	620.00	418.00
676	Narayan Khera	BARAN	Shahbad	Chambal	Parwati	Minor	25.115498	76.997459	8.90	3,540.00	6.69	3.93	144.00	261.12		960.61	200.00	815.00
662	Rampura	BARAN	Shahbad	Chambal	Parwati	MINOR	25.260231	77.076048		936.00	1.90	1.09	N.A.			N.A.	156.00	N.A.
663	Ratai	BARAN	Shahbad	Chambal	Parwati	MINOR	25.138954	77.062953	9.75	914.00	7.46	9.58	-	622.60		1,700.00	1,312.00	1,118.00
665	Seharol telhati	BARAN	Shahbad	Chambal	Parwati	MINOR	25.205537	77.078022		320.00	1.33	0.70	N.A.			N.A.	100.00	N.A.
666	Semali Phatak	BARAN	Shahbad	Chambal	Parwati	MINOR	25.252663	77.082723		2,315.00	2.36	4.00	87.59			497.30	121.00	407.53
	Sub Basin Total										**79.90**	**98.74**				**10,205.91**	**13,916.00**	**7,347.53**
	Basin Total										**358.80**	**472.78**				**56,127.79**	**78,757.04**	**45,675.25**
1022	Bagera Bund	BHARATPUR	Bayana	Gambhir	Gambhir	Minor	26.908687	77.171114			0.48	0.48					105.26	
1023	Baisora	BHARATPUR	Bayana	Gambhir	Gambhir	Minor	26.751482	77.438131	2.01	810.00	0.29	0.29	Nil	2,280.00	Nil	50.00	50.20	50.00
860	Bangarra	BHARATPUR	Bayana	Gambhir	Gambhir	MINOR	26.802358	77.424026	3.02	4,500.00	0.15	0.15	Nil	1,118.00	Nil	38.70	38.40	38.70
876	Bayara	BHARATPUR	Bayana	Gambhir	Gambhir	MINOR	26.976713	77.234354				0.48					175.00	
867	Bhagaura Upper	BHARATPUR	Bayana	Gambhir	Gambhir	MINOR	26.975374	77.249063	4.11	930.00	0.19	0.15	NA	32.50	Not Canal	NA	40.15	NA
872	Bhim Nagar	BHARATPUR	Bayana	Gambhir	Gambhir	MINOR	26.935492	77.289999	1.01	1,050.00	0.34	0.34	Nil	1,000.00	Nil	40.32	67.50	40.32
891	Damdama	BHARATPUR	Bayana	Gambhir	Gambhir	MINOR	26.932943	77.268786	2.49	1,050.00	0.74	0.74	Nil	2,240.00	Nil	129.03	129.00	129.03
894	Dehgaon	BHARATPUR	Bayana	Gambhir	Gambhir	MINOR	26.990782	77.283743	3.51	3,150.00	0.40	0.40	Nil	2,250.00	Nil	96.77	96.00	96.77
1030	Dundi	BHARATPUR	Bayana	Gambhir	Gambhir	Minor	26.772522	77.370998	1.51	2,100.00	0.74	0.74	Nil	3,300.00	Nil	96.77	97.16	96.77
913	Jaisora	BHARATPUR	Bayana	Gambhir	Gambhir	MINOR	26.755645	77.420087	3.01	1,590.00	0.45	0.40	Nil	3,376.00	Nil	9.06	76.00	9.06
925	Kamal Hoze	BHARATPUR	Bayana	Gambhir	Gambhir	MINOR	26.917895	77.283657	3.49	300.00	0.43	0.40	NIL	800.00	3.51	68.55	69.00	68.55
1031	Kasba Bayana	BHARATPUR	Bayana	Gambhir	Gambhir	Minor	26.935248	77.289983	1.75	600.00	0.43	0.21	NIL	440.00	NIL	NIL	48.58	NIL
934	Khatnawali	BHARATPUR	Bayana	Gambhir	Gambhir	MINOR	26.999708	77.255978	2.49	2,430.00	1.22	1.22	NIL	792.00	NIL	209.67	351.00	209.67
960	Nagla Chhitriya	BHARATPUR	Bayana	Gambhir	Gambhir	MINOR	26.982857	77.288960	3.75	2,622.00	0.58	0.58	NIL	6,280.00	NIL	2,120.96	21.10	2,120.96
961	Nagla Sher Singh	BHARATPUR	Bayana	Gambhir	Gambhir	MINOR	26.986530	77.262498	1.75	2,790.00	0.59	0.59	NIL	6,280.00	NIL	177.41	177.00	177.41
968	New Kani	BHARATPUR	Bayana	Gambhir	Gambhir	MINOR	26.773016	77.425043	1.81	1,230.00	0.31	0.31	NIL	1,683.00	NIL	32.25	32.00	32.25
973	Old Kani	BHARATPUR	Bayana	Gambhir	Gambhir	MINOR	26.763770	77.421938				0.40					76.00	
974	Old Kanwar	BHARATPUR	Bayana	Gambhir	Gambhir	MINOR	26.951035	77.265711	1.75	2,400.00	0.17	0.16	NIL	1,584.00	NIL	145.16	81.00	145.16
1036	Parua	BHARATPUR	Bayana	Gambhir	Gambhir	Minor	26.810369	77.392876				0.80					259.10	
990	Richholi	BHARATPUR	Bayana	Gambhir	Gambhir	MINOR	27.002834	77.372580	2.47	5,730.00	2.04	2.03	2.88	792.00	NA	971.00	774.00	971.00
998	Samant garh	BHARATPUR	Bayana	Gambhir	Gambhir	MINOR	26.765405	77.455775	2.01	1,200.00	0.85	0.96	NIL	824.00	NIL	56.45	56.00	56.45
1038	Shergarh	BHARATPUR	Bayana	Gambhir	Gambhir	Minor	26.881990	77.290345	1.51	2,145.00	0.25	0.02	NIL	792.00	NIL	80.64	32.38	80.64
1011	Sigarawali	BHARATPUR	Bayana	Gambhir	Gambhir	MINOR	26.762306	77.435243	1.51	780.00	0.20	0.20	NIL	1,584.00	NIL	139.91	84.00	139.91
853	Barbar	BHARATPUR	Rupbas	Gambhir	Gambhir	MINOR	27.010526	77.579489	4.11	1,150.00	0.30	0.08	NA	1,120.00	NA	340.00	18.20	340.00
864	Basai Bund	BHARATPUR	Rupbas	Gambhir	Gambhir	MINOR	26.924817	77.509017	1.75	2,250.00	0.50	0.50	NIL	3,088.00	NIL	44.35	113.00	44.35
877	Binaua	BHARATPUR	Rupbas	Gambhir	Gambhir	MINOR	26.993641	77.535991	1.45	2,340.00	0.30	0.30	NIL	1,584.00	NIL	88.71	56.00	88.71
879	Bokoli	BHARATPUR	Rupbas	Gambhir	Gambhir	MINOR	27.009822	77.567746			1.64	1.64					148.00	
885	Chainkora	BHARATPUR	Rupbas	Gambhir	Gambhir	MINOR	26.992245	77.641427	1.71	2,400.00	0.85	0.85	NIL	1,584.00	02.51 km	100.81	202.00	100.81
893	Daurda	BHARATPUR	Rupbas	Gambhir	Gambhir	MINOR	27.000015	77.563147			0.17	0.17					38.00	
899	Dumriya	BHARATPUR	Rupbas	Gambhir	Gambhir	MINOR	26.938605	77.415853	1.51	1,740.00	0.74	0.74	NIL	85.00	NIL	120.96	203.00	120.96
915	Jatmansi Bund	BHARATPUR	Rupbas	Gambhir	Gambhir	MINOR	26.964058	77.530957	1.81	2,250.00	0.26	0.31	NIL	638.00	NIL	32.25	216.00	32.25
918	Jetroli Lower	BHARATPUR	Rupbas	Gambhir	Gambhir	MINOR	26.975000	77.491667	1.69	1,350.00	0.18	0.18	NIL	220.00	NIL	48.38	216.00	48.38
919	Jetroli Upper	BHARATPUR	Rupbas	Gambhir	Gambhir	MINOR	26.986009	77.484684	1.79	1,080.00	0.31	0.26	NIL	1,584.00	NIL	56.45	54.00	56.45
922	Kachha Bansi	BHARATPUR	Rupbas	Gambhir	Gambhir	MINOR	26.949576	77.521290	1.79	1,230.00	0.26	0.26	NIL	6,281.00		80.64	101.00	80.64
927	Kanjar Baroli	BHARATPUR	Rupbas	Gambhir	Gambhir	MINOR	26.989489	77.507996	6.70	1,920.00	0.31	1.00	NA	18,000.00	NA	648.00	307.00	648.00
928	Karai	BHARATPUR	Rupbas	Gambhir	Gambhir	MINOR	26.995833	77.662500	1.82	270.00	1.52	1.75	NIL	452.00	NIL	1.19	169.00	1.19
930	Kasba Roopwas	BHARATPUR	Rupbas	Gambhir	Gambhir	MINOR	27.004217	77.584696				0.30					60.00	
932	KhanSurjapur Upper	BHARATPUR	Rupbas	Gambhir	Gambhir	MINOR	26.981899	77.635296	3.81	1,700.00	0.30	0.30	0.80	808.00	NA	324.00	81.00	324.00
1032	Khasurjapur Lower	BHARATPUR	Rupbas	Gambhir	Gambhir	Minor	26.981097	77.636034	1.49	450.00	0.74	0.74	NIL	792.00	NIL	17.74	178.00	17.74
935	Kheda Jamadari	BHARATPUR	Rupbas	Gambhir	Gambhir	MINOR	26.967248	77.436022	2.41	1,230.00	0.74	0.74	NIL	792.00	NIL	72.58	122.00	72.58
936	Kheda Rudawal	BHARATPUR	Rupbas	Gambhir	Gambhir	MINOR	26.972250	77.420074	2.41	300.00	0.74	0.74	NIL	4,854.00	NIL	181.45	304.00	181.45
938	Kheria Lower	BHARATPUR	Rupbas	Gambhir	Gambhir	MINOR	26.971050	77.618814				0.26					68.00	
939	Kheria Upper	BHARATPUR	Rupbas	Gambhir	Gambhir	MINOR	26.964178	77.602027				0.26					135.00	
940	Kherli Bund	BHARATPUR	Rupbas	Gambhir	Gambhir	MINOR	26.934110	77.570436	1.79	3,360.00	0.82	0.82	NIL	4,816.00	NIL	216.93	74.00	216.93
944	Kundanwara	BHARATPUR	Rupbas	Gambhir	Gambhir	MINOR	27.015541	77.561048				0.15					49.00	
945	Kurka	BHARATPUR	Rupbas	Gambhir	Gambhir	MINOR	27.030666	77.414991	2.44	5,730.00	3.94	1.84	NA	583.00	1.00	567.00	566.80	567.00
949	Lakhanpura	BHARATPUR	Rupbas	Gambhir	Gambhir	MINOR	26.944210	77.458410				0.14					47.00	
951	Mahalpura Kachhi	BHARATPUR	Rupbas	Gambhir	Gambhir	MINOR	27.008333	77.504167	2.75	1,350.00	2.46	2.46	NIL	6,272.00	NIL	181.45	54.00	181.45
953	Mertha	BHARATPUR	Rupbas	Gambhir	Gambhir	MINOR	26.992227	77.705661	1.01	1,560.00	5.72	0.10	NIL	1,152.00	NIL	983.87	17.00	983.87
954	Moloni Lower	BHARATPUR	Rupbas	Gambhir	Gambhir	MINOR	26.945283	77.584573	3.01	2,400.00	0.88	0.87	NIL	11,269.00	NIL	32.25	81.00	32.25
955	Moloni Upper	BHARATPUR	Rupbas	Gambhir	Gambhir	MINOR	26.929464	77.569229				0.10					74.00	
963	Nathpura Bund	BHARATPUR	Rupbas	Gambhir	Gambhir	MINOR	26.949886	77.420931	1.75	2,190.00	1.31	0.04	NIL	792.00	NIL	32.25	32.00	32.25
972	Noharda	BHARATPUR	Rupbas	Gambhir	Gambhir	MINOR	26.941503	77.557651	1.69	1,830.00	0.77	0.76	NIL	1,400.00	NIL	48.38	65.00	48.38
975	Ondel Jat	BHARATPUR	Rupbas	Gambhir	Gambhir	MINOR	27.006663	77.536234	1.51	840.00	0.17	0.16	NIL	3,167.00	NIL	161.29	200.00	161.29
983	Pucca Bansi	BHARATPUR	Rupbas	Gambhir	Gambhir	MINOR	26.956539	77.571932	1.72	240.00	0.20	0.20	NIL	1,283.00	NIL	60.48	60.00	60.48
987	Rajpura	BHARATPUR	Rupbas	Gambhir	Gambhir	MINOR	26.965184	77.478976				0.18					270.00	
991	Roondh Samari	BHARATPUR	Rupbas	Gambhir	Gambhir	MINOR	26.953729	77.583399	2.01	1,500.00	3.11	0.31	NIL	2,376.00	NIL	80.64	108.00	80.64
1037	Sajeri Bund	BHARATPUR	Rupbas	Gambhir	Gambhir	Minor	26.937956	77.541140				0.48					105.26	
994	Sajjanbas	BHARATPUR	Rupbas	Gambhir	Gambhir	MINOR	26.934091	77.580264	2.01	2,190.00	0.53	0.53	NIL	6,261.00	NIL	44.35	44.00	44.35

S. No.	Project Name	District	Block	Basin	Sub-basin	Class	Latitude (DD)	Longitude (DD)	Ht. above Lowest Foundation (m)	Length of Dam (m)	Gross Storage Capacity (Mm^3)	Live Storage Capacity (Mm^3)	Reservoir Area at FRL (km^2)	Design Spilway Capacity (cusecs)	Length of Canal System (km)	Command Area (ha)		
																GCA	CCA	ICA
1	2	3	4	5	6	7	9	10	11	12	13	14	15	16	17	18	19	20
995	Sakkarpur	BHARATPUR	Rupbas	Gambhir	Gambhir	MINOR	27.002116	77.673396	2.49	2,700.00	1.61	0.62	NIL	1,614.00	NIL	270.16	101.00	270.16
996	Samad Lower	BHARATPUR	Rupbas	Gambhir	Gambhir	MINOR	26.977683	77.566571	1.75	1,500.00	8.49	0.09	NIL	4,290.00	NIL	56.45	56.00	56.45
997	Samad Upper	BHARATPUR	Rupbas	Gambhir	Gambhir	MINOR	26.968271	77.560487	1.75	1,470.00	8.49	0.09	NIL	2,182.00	NIL	56.45	56.00	56.45
999	Samesara Lower	BHARATPUR	Rupbas	Gambhir	Gambhir	MINOR	26.981258	77.653763	3.11	2,010.00	0.85	0.86	0.96	2,910.00	NA	534.00	201.00	534.00
1000	Samesara Upper	BHARATPUR	Rupbas	Gambhir	Gambhir	MINOR	26.999252	77.638185	2.01	1,950.00	8.49	0.74	NIL	2,376.00	NIL	241.93	226.00	241.93
1013	Sirondh	BHARATPUR	Rupbas	Gambhir	Gambhir	MINOR	26.987864	77.478546	2.01	1,200.00	0.42	0.43	NIL	1,584.00	NIL	32.25	32.00	32.25
1016	Ballabhgarh	BHARATPUR	Weir	Gambhir	Gambhir	MINOR	26.960730	77.086209			0.48	0.48					95.00	
1024	Bhagaura Upper	BHARATPUR	Weir	Gambhir	Gambhir	Minor	26.973061	77.197406			0.15	0.15					40.48	
903	Guthakar	BHARATPUR	Weir	Gambhir	Gambhir	MINOR	26.993230	77.239629				1.08					108.00	
926	Kanawar	BHARATPUR	Weir	Gambhir	Gambhir	MINOR	26.956115	77.257081	2.51	2,550.00	0.42	0.42	Nil	980.00	Nil	145.16	243.00	145.16
1690	Bada Gaon Kheda	DAUSA	Mahwa	Gambhir	Gambhir	MINOR	26.903719	76.990001	NA	91.00	2.20	2.20	NA	95.24	Petakast	NA	60.10	Petakast
1725	Kondra	DAUSA	Mahwa	Gambhir	Gambhir	NA	26.942967	76.966344	6.70	1,410.00	0.59	1.17	0.51	124.12	0.38	172.77	167.00	144.00
1718	Samaspura	DAUSA	Mahwa	Gambhir	Gambhir	MINOR	26.898638	77.057183	NA	1,065.00	0.90	0.88	NA	93.43	Petakast	NA	253.30	Petakast
1719	Sikandarpura	DAUSA	Mahwa	Gambhir	Gambhir	MINOR	26.896504	77.023122	NA	289.00	1.20	1.22	NA	NA	Petakast	NA	289.10	Petakast
1721	Siswara	DAUSA	Mahwa	Gambhir	Gambhir	MINOR	26.876669	77.047629	NA	912.00	2.70	2.72	NA	93.54	Petakast	NA	649.80	Petakast
1734	Dhaur Bund	DHAULPUR	Baseri	Gambhir	Gambhir	MINOR	26.713201	77.444792	2.21	3,600.00	0.62	0.74	NIL	200.00	03.5 km	338.71	80.90	338.71
1755	Dhor Bund	DHAULPUR	Baseri	Gambhir	Gambhir	Minor	26.712232	77.444011	NA	200.00	0.89	0.89	NA	NA	1.50	NA	162.00	80.90
1752	Singhora	DHAULPUR	Dhaulpur	Gambhir	Gambhir	Minor	26.891682	77.816420	NA	200.00	0.05	0.05	NA	NA	Bed cultivation	NA	12.14	6.87
2438	Jalsen	KARAULI	Hindaun	Gambhir	Gambhir	MINOR	26.725000	77.037500				1.46					106.10	
2439	Jatwara	KARAULI	Hindaun	Gambhir	Gambhir	MINOR	26.712122	77.012554				0.57					182.20	
2444	Kyarda	KARAULI	Hindaun	Gambhir	Gambhir	MINOR	26.779648	77.020880				2.18					243.00	
2427	Bandhawa	KARAULI	Karauli	Gambhir	Gambhir	MINOR	26.592334	77.026854			2.59	2.39		NA		605.00	589.50	3,740.00
2471	Bheetke	KARAULI	Karauli	Gambhir	Gambhir	Minor	26.536690	77.144349				0.35					40.00	
2472	Dafalpur	KARAULI	Karauli	Gambhir	Gambhir	Minor	26.483539	76.846270				0.22					8.00	
2432	Doriyan Ka Tal	KARAULI	Karauli	Gambhir	Gambhir	MINOR	26.646960	77.198290				1.13					172.90	
2466	Madan Sagar	KARAULI	Karauli	Gambhir	Gambhir	Minor	26.688276	77.190570				0.80					175.00	
2446	Madanpur	KARAULI	Karauli	Gambhir	Gambhir	MINOR	26.676206	77.206508				0.88					182.20	
2447	Mamchari	KARAULI	Karauli	Gambhir	Gambhir	MINOR	26.434302	76.958241				4.11					963.60	
2465	Zerda	KARAULI	Karauli	Gambhir	Gambhir	MINOR	26.508068	77.130973				0.27					60.70	
2433	Fateh Sagar	KARAULI	Nadoti	Gambhir	Gambhir	MINOR	26.712211	76.783088	23.38			3.64		13,140.00		1,306.00	518.20	
2435	Guman Sagar	KARAULI	Nadoti	Gambhir	Gambhir	MINOR	26.779514	76.647410				0.80					164.80	
2436	Hodaheli	KARAULI	Nadoti	Gambhir	Gambhir	MINOR	26.713272	76.740407				1.70					323.00	
2437	Jadolao	KARAULI	Nadoti	Gambhir	Gambhir	MINOR	26.786944	76.666131				0.45					40.50	
2451	Mohanpura (G.G.C.)	KARAULI	Nadoti	Gambhir	Gambhir	MINOR	26.774094	76.751532				4.00					1,012.10	
2476	Najimwala Kunjela	KARAULI	Nadoti	Gambhir	Gambhir	Minor	26.675486	76.797824				0.77					117.00	
2467	Naya Talab Kaima	KARAULI	Nadoti	Gambhir	Gambhir	Minor	26.664013	76.722908				1.70					127.00	
2454	New Tank Kema	KARAULI	Nadoti	Gambhir	Gambhir	MINOR	26.684623	76.741271				0.79					81.00	
2461	Ram Sagar	KARAULI	Nadoti	Gambhir	Gambhir	MINOR	26.627298	76.762205				1.43					117.00	
2462	Ronsi	KARAULI	Nadoti	Gambhir	Gambhir	MINOR	26.689694	76.850034				1.47					201.20	
2430	Bonl ~Sawai	KARAULI	Todabhim	Gambhir	Gambhir	MINOR	26.850027	76.918202				2.04					283.40	
2473	Dhawali	KARAULI	Todabhim	Gambhir	Gambhir	Minor	26.794019	76.749467				0.37					35.00	
2455	New Tank Maheshwa	KARAULI	Todabhim	Gambhir	Gambhir	MINOR	26.746388	76.795619				3.60		2,770.00		1,035.00	1,012.10	4,072.00
2456	Old Tank Maheshwa	KARAULI	Todabhim	Gambhir	Gambhir	MINOR	26.758015	76.804771				0.99					236.80	
2459	Rajoli	KARAULI	Todabhim	Gambhir	Gambhir	MINOR	26.800043	76.780537				0.96					339.70	
2470	Vishan Samand	KARAULI	Todabhim	Gambhir	Gambhir	Minor	26.889247	76.944178				11.55					1,648.00	
2840	Bada Talab Najimwala	SAWAI MADHOPUR	Gangapur	Gambhir	Gambhir	MINOR	26.533679	76.869657				0.57					72.00	
2842	Bajneka	SAWAI MADHOPUR	Gangapur	Gambhir	Gambhir	MINOR	26.516420	76.852209	NA	731.00	0.12	0.12	NA	NA	Petakast	NA	20.30	NA
2862	Jhohariwala	SAWAI MADHOPUR	Gangapur	Gambhir	Gambhir	MINOR	26.537359	76.826647				0.94	0.93				301.40	
2893	Khandeep	SAWAI MADHOPUR	Gangapur	Gambhir	Gambhir	Minor	26.618109	76.893810	NA	NA	0.65	0.65	NA	NA	Petakast	NA	300.00	NA
2869	Naya Talab Sewa	SAWAI MADHOPUR	Gangapur	Gambhir	Gambhir	MINOR	26.532902	76.831224			0.47	0.47					248.00	
2870	Naya Talab Syaroli	SAWAI MADHOPUR	Gangapur	Gambhir	Gambhir	MINOR	26.542150	76.847001			0.58	0.58					222.60	
2874	Peedia Bandhli	SAWAI MADHOPUR	Gangapur	Gambhir	Gambhir	MINOR	26.503954	76.845580			0.62	0.62					20.30	
2877	Ram Talab	SAWAI MADHOPUR	Gangapur	Gambhir	Gambhir	MINOR	26.543258	76.830470			0.44	0.42					132.70	
2883	Telanwala	SAWAI MADHOPUR	Gangapur	Gambhir	Gambhir	MINOR	26.581996	76.898645			0.56	0.57					134.80	
	Basin Total										**86.09**	**102.93**				**13,822.92**	**20,837.01**	**18,747.92**
1985	Checkla Bund	JALORE	Jaswantpura	Luni	Bandi	MINOR	24.827095	72.437805	6.95 M	1105.0 M	0.24	0.18	-	46.41	480.00 m	-	35.00	35.00 5.00
2051	Pawati bund	JALORE	Jaswantpura	Luni	Bandi	MINOR	24.889674	72.453580	7.50	227.00	0.13	0.13	-	37.58			25.00	25.00
2056	Puran Bund	JALORE	Jaswantpura	Luni	Bandi	MINOR	24.761542	72.489867	9.33	587.50	0.53	0.42	-	152.68	5400 ft.	99.20	121.00	61.00
2098	Uchmat bund	JALORE	Jaswantpura	Luni	Bandi	MINOR	24.776276	72.448006		788.00	0.77	0.70	-	147.30		260.50	238.58	100.58
2099	Vada Bhavji bund	JALORE	Jaswantpura	Luni	Bandi	MINOR	24.769662	72.467836	6.84	147.00	0.22	0.22	-	61.70	0.54 km	47.00	46.15	31.98
2945	Amlari	SIROHI	Sirohi	Luni	Bandi	MINOR	24.768312	72.553575	6.10	697.17	0.43	0.33	0.19	1,900.00	2.00	86.23	59.60	35.63
3006	Kurnia	SIROHI	Sirohi	Luni	Bandi	Minor	24.788964	72.548207	3.54	159.45	0.28	0.27	NA	2,310.00	1.20	50.60	46.96	37.65
2985	Nimbora	SIROHI	Sirohi	Luni	Bandi	MINOR	24.886384	72.552312	10.43	1,620.00	0.95	1.94	0.55	11,010.00	3.90	727.00	499.00	276.81
2991	Punawa	SIROHI	Sirohi	Luni	Bandi	MINOR	24.759622	72.522324	6.00	410.00	0.42	0.42	0.09	2,276.00	1.40	85.43	70.00	48.58
	Sub Basin Total										**3.96**	**4.61**				**1,355.96**	**1,141.29**	**617.23**
133	Dudaleshwer	AJMER	Jawaja	Luni	Bandi (Hemawas)	MINOR	25.709686	73.953283	NA	150.00	5.00	0.14	NA	991.00	0.62	34.00	33.59	20.00

S. No.	Project Name	District	Block	Basin	Sub-basin	Class	Latitude (DD)	Longitude (DD)	Ht. above Lowest Foundation (m)	Length of Dam (m)	Gross Storage Capacity (Mm^3)	Live Storage Capacity (Mm^3)	Reservoir Area at FRL (km^2)	Design Spilway Capacity (cusecs)	Length of Canal System (km)	Command Area (ha)		
																GCA	CCA	ICA
1	2	3	4	5	6	7	9	10	11	12	13	14	15	16	17	18	19	20
327	Reachawa Talab	AJMER	Jawaja	Luni	Bandi (Hemawas)	MINOR	25.746262	73.990480				0.28					60.00	
2601	Baniawas	PALI	Marwar Junction	Luni	Bandi (Hemawas)	MINOR	25.774919	73.576954				7.84					1,462.00	
2605	Borinada	PALI	Marwar Junction	Luni	Bandi (Hemawas)	MINOR	25.701496	73.871632	2.25	4,026.00	1.72	1.72	NA	9,465.00	2.10	842.00	336.00	242.00
2695	Chirpatiya	PALI	Marwar Junction	Luni	Bandi (Hemawas)	Minor	25.714378	73.696478	2.70	4,710.00	2.13	2.05	NA	19,500.00		1,828.00	1,502.00	405.00
2611	Dingor Bandh	PALI	Marwar Junction	Luni	Bandi (Hemawas)	MINOR	25.645396	73.821330				0.99					138.00	
2632	Kantaliya	PALI	Marwar Junction	Luni	Bandi (Hemawas)	MINOR	25.746616	73.659050	7.00	572.00	5.34	5.18	NA	19,878.00	8.19	838.00	759.00	611.00
2657	Phulad	PALI	Marwar Junction	Luni	Bandi (Hemawas)	MINOR	25.773687	73.821893	8.23	735.00	3.72	3.49	NA	20,894.00	5.19	879.00	810.00	498.00
2674	Saran	PALI	Marwar Junction	Luni	Bandi (Hemawas)	MINOR	25.715055	73.832323	3.50	330.00	1.87	1.71	NA	3,980.00	3.60	524.00	347.00	263.00
2681	Siriyari	PALI	Marwar Junction	Luni	Bandi (Hemawas)	MINOR	25.681356	73.822028	7.93	250.00	4.48	4.13	NA	11,433.00	7.44	805.00	780.00	591.00
2604	Bomadra Pickup weir	PALI	Pali	Luni	Bandi (Hemawas)	MINOR	25.766317	73.449233	1.92	5,029.00	1.27	1.27		1,811.20	Diversion Scheme		181.61	
2626	Jogawas-I	PALI	Pali	Luni	Bandi (Hemawas)	MINOR	25.768756	73.510456	2.28	1,213.00	3.36	2.27	NA	11,000.00	3.66	931.00	842.00	486.00
2627	Jogawas-II	PALI	Pali	Luni	Bandi (Hemawas)	MINOR	25.768756	73.510456	2.28	1,213.00	3.36	0.68	NA	11,000.00	3.66	931.00	97.24	486.00
2642	Lohriya	PALI	Pali	Luni	Bandi (Hemawas)	MINOR	25.783671	73.328816		3,350.00	1.23	1.23		31.13	0.15	159.00	138.00	121.00
2624	Hariomsagar	PALI	Rohat	Luni	Bandi (Hemawas)	MINOR	25.883323	72.996608	16.11	1,630.00	1.34	1.33	NA	113.87	4,730.00	315.88	316.00	260.00
	Sub Basin Total										**34.82**	**34.32**				**8,086.88**	**7,802.44**	**3,983.00**
60	Banjaree Talab	AJMER	Jawaja	Luni	Guhiya	MINOR	25.785729	74.050889	NA	80.00	6.70	0.19	NA	540.00	3.10	48.00	32.00	27.00
74	Bhaduka Talab	AJMER	Jawaja	Luni	Guhiya	MINOR	25.776701	74.023479	NA	56.00	8.00	0.23	NA	2,536.00	1.90	66.00	40.00	32.00
81	Bheem Gagelav	AJMER	Jawaja	Luni	Guhiya	MINOR	25.747243	74.000748	NA	28.00	6.50	0.18	NA	871.00	2.46	48.00	40.00	26.00
91	Borawas Talab	AJMER	Jawaja	Luni	Guhiya	MINOR	25.776095	73.965293				0.16					30.00	
164	Jalia Pithawas	AJMER	Jawaja	Luni	Guhiya	MINOR	25.929651	74.180618	NA	145.00	14.78	0.40	NA	5,525.00	2.56	122.00	99.00	57.00
170	Jawaja Tank	AJMER	Jawaja	Luni	Guhiya	MINOR	26.039513	74.205507	NA	378.00	2.25	2.24	NA	4,816.00	7.85	670.18	528.00	321.00
202	Kharunja Borkh	AJMER	Jawaja	Luni	Guhiya	MINOR	25.754014	73.998614				0.20					28.00	
215	Kolatalab Bhagmal	AJMER	Jawaja	Luni	Guhiya	MINOR	25.799261	73.988928				0.20					40.00	
217	Laburi Tank	AJMER	Jawaja	Luni	Guhiya	MINOR	25.797040	74.007878	NA	240.00	12.33	0.33	NA	2,797.00	2.08	88.00	44.00	47.00
225	Lassri Tank	AJMER	Jawaja	Luni	Guhiya	MINOR	25.900000	74.166667	NA	490.00	31.69	0.90	NA	3,761.00	5.46	263.00	210.00	125.00
226	Latelao Badakheda	AJMER	Jawaja	Luni	Guhiya	MINOR	25.791424	74.023670				0.14					26.00	
230	Lothiyana Talab	AJMER	Jawaja	Luni	Guhiya	MINOR	25.894056	74.190133				0.30					80.00	
282	Padabhagard (Bada kheda)	AJMER	Jawaja	Luni	Guhiya	MINOR	25.805556	74.041667	NA	360.00	6.00	0.20	NA	1,241.00	2.25	52.00	36.00	24.00
300	Prem Sagar Kalingar	AJMER	Jawaja	Luni	Guhiya	MINOR	26.018093	74.169095	NA	670.00	8.07	0.20	NA	940.00	1.67	48.00	36.00	26.00
324	Rata Bhata	AJMER	Jawaja	Luni	Guhiya	MINOR	25.905556	74.172222	NA	100.00	6.09	0.20	NA	4,596.00	1.58	44.00	36.00	24.00
330	Roop Nagar Arnali	AJMER	Jawaja	Luni	Guhiya	MINOR	25.796117	74.051321	NA	67.00	21.73	0.62	NA	743.00	2.39	120.00	100.00	85.00
347	Sheron Ka Bala	AJMER	Jawaja	Luni	Guhiya	MINOR	25.880634	74.137440				0.50					95.00	
2204	Bairna Anicut-I	JODHPUR	Bilara	Luni	Guhiya	MINOR	26.114714	73.757892				0.14					31.61	
2378	Barna BundhII	JODHPUR	Bilara	Luni	Guhiya	Minor	26.113643	73.765354				0.09					13.00	
2244	Borunda Bandh	JODHPUR	Bilara	Luni	Guhiya	MINOR	26.095582	73.479293				1.45					259.00	
2269	Hariyada Anicut-I	JODHPUR	Bilara	Luni	Guhiya	MINOR	26.115160	73.470911				1.55					54.00	
2272	Holpur Anicut	JODHPUR	Bilara	Luni	Guhiya	MINOR	26.139464	73.465369				0.15					29.15	
2296	Khutlia Anicut	JODHPUR	Bilara	Luni	Guhiya	MINOR	26.085068	73.506382				0.08					12.00	
2330	Padasala Tekri Anicut	JODHPUR	Bilara	Luni	Guhiya	MINOR	26.134841	73.554818				0.05					5.70	
2332	Parasala Khurd Anicut	JODHPUR	Bilara	Luni	Guhiya	MINOR	26.128407	73.528042				0.15					20.81	
2410	Pipalia Ganwai Nadi Anicut	JODHPUR	Bilara	Luni	Guhiya	Minor	26.145009	73.666113				0.06					9.00	
2230	Bhatinda Malkosni Khadeen	JODHPUR	Luni	Luni	Guhiya	MINOR	26.067578	73.339852				0.09					18.00	
2599	Bamboli Bundh	PALI	Pali	Luni	Guhiya	MINOR	25.863426	73.375761				0.20					60.00	
2614	Gajnai	PALI	Pali	Luni	Guhiya	MINOR	25.860864	73.396213	10.00	210.00	6.37	6.25	NA	46,000.00	15.62	1,418.00	1,290.00	897.00
2619	Govind Sagar Bandh	PALI	Raipur	Luni	Guhiya	MINOR	26.081757	73.831004	1.22	2,683.00	0.44	0.49	NA	1,350.00	-		80.00	80.00
2673	Salnadi	PALI	Raipur	Luni	Guhiya	MINOR	25.982999	74.062353	6.20	1,590.00	0.61	0.61	NA	92.31	1.14	135.97	94.00	81.83
2635	Khandi Bandh	PALI	Rohat	Luni	Guhiya	MINOR	25.936763	73.022336	3.70	1,965.00	0.45	0.45	-	90.28	-	140.00	140.00	121.00
2652	Mukund Sagar	PALI	Rohat	Luni	Guhiya	MINOR	25.918609	73.176861	5.80	216.38	39.08	1.11	250.00	4,705.00	3,150.00	176.13	176.00	116.96
2600	Bandi Nehra	PALI	Sojat	Luni	Guhiya	MINOR	25.884323	73.977274	8.75	7,200.00	7.36	6.51		2,603.60	17.65	1,456.00	1,452.00	1,162.00
2608	Deoli Hulla Bandh	PALI	Sojat	Luni	Guhiya	MINOR	25.915597	73.911362	1.98	976.00	0.71	0.71	NA	4,970.00	1.24	71.00	59.00	51.00
2609	Dhakri Bandh	PALI	Sojat	Luni	Guhiya	MINOR	25.918618	73.579598	1.82	1,585.00	0.59	0.59	NA	4,300.00	-	439.00	120.00	86.00
2618	Godelao Bandh	PALI	Sojat	Luni	Guhiya	MINOR	26.045999	73.582110	2.44	311.00	0.67	0.64	NA	4,756.00	-	91.00	88.00	85.00
2623	Hapat Bandh	PALI	Sojat	Luni	Guhiya	MINOR	26.099196	73.407586	0.76	2,220.00	0.39	0.39	NA	1,888.00		20.00	15.00	11.00
2698	Jaipalia	PALI	Sojat	Luni	Guhiya	Minor	26.016535	73.479885	6.18	50.00	0.13	0.10	NA	25.75	-	-	23.00	-
2638	Khokhra Bandh	PALI	Sojat	Luni	Guhiya	MINOR	25.949550	73.763459	1.83	3,523.00	0.60	0.60	NA	3,560.00	-		109.00	109.00
2645	Malpuriya Kanawas	PALI	Sojat	Luni	Guhiya	MINOR	25.893684	73.470030	2.15	1,048.00	5.53	5.08	NA	15,050.00	2.72	892.00	877.00	621.00
2647	Mandala Bandh	PALI	Sojat	Luni	Guhiya	MINOR	25.961400	73.732747	3.00	655.00	0.22	0.22	NA	875.00	1.32	56.00	50.00	35.00
2665	Raj Sagar Chopra	PALI	Sojat	Luni	Guhiya	MINOR	26.054074	73.455110	4.60	7,680.00	8.16	8.00	NA	13,667.00	9.90	2,397.00	1,670.00	1,320.00
2667	Ramasani bala Bandh	PALI	Sojat	Luni	Guhiya	MINOR	25.975646	73.682011	3.75	630.00	0.55	0.55	NA	3,266.00	1.80	107.00	104.00	74.00
2669	Reparawas Bandh	PALI	Sojat	Luni	Guhiya	MINOR	26.068786	73.558355				0.32					93.00	
2670	Rodawas	PALI	Sojat	Luni	Guhiya	MINOR	25.831238	73.917400				1.27					190.00	
	Sub Basin Total										**196.00**	**45.08**				**8,968.28**	**8,642.27**	**5,644.79**
821	Bhilon ki dhani (Bhagwa anicut)	BARMER	Siwana	Luni	Jawai	Minor	25.489925	72.459408	3.40	420.00	0.20	0.20	-	32.32	-	25.50	25.50	25.50
804	Talwarwala Khadeen I (Chuli)	BARMER	Siwana	Luni	Jawai	MINOR	25.455147	72.403179	2.85	673.00	0.12	0.12	-	44.13	-	32.00	32.00	32.00
1981	Budira bund	JALORE	Ahore	Luni	Jawai	MINOR	25.308333	72.800000				0.20					66.23	
1983	Chavarcha Bund -I	JALORE	Ahore	Luni	Jawai	MINOR	25.290601	72.820987	4.69	62.59	7.92	7.85	10.32	335.00		1,975.00	496.50	205.30

S. No.	Project Name	District	Block	Basin	Sub-basin	Class	Latitude (DD)	Longitude (DD)	Ht. above Lowest Foundation (m)	Length of Dam (m)	Gross Storage Capacity (Mm^3)	Live Storage Capacity (Mm^3)	Reservoir Area at FRL (km^2)	Design Spilway Capacity (cusecs)	Length of Canal System (km)	Command Area (ha)		
																GCA	CCA	ICA
1	2	3	4	5	6	7	9	10	11	12	13	14	15	16	17	18	19	20
1984	Chawarcha bund II	JALORE	Ahore	Luni	Jawai	MINOR	25.285892	72.822702	4.71 M	2215 M	0.15	0.15	-	9.63	-	45.35	45.35	45.35
2109	Kaniwara khadeen	JALORE	Jalore	Luni	Jawai	Minor	25.339220	72.709890				0.21					56.00	
2113	Katkeshwar anicut	JALORE	Jalore	Luni	Jawai	Minor	25.282515	72.693153	5.10 M	1545 M	0.37	0.37	-	69.73	-	-	57.48	7.00
2038	Meda Uperia bund	JALORE	Jalore	Luni	Jawai	MINOR	25.312340	72.738361	6.32 M	1950 M	0.71	0.70	-	134.00	1.92	303.54	50.00	126.00
2057	Rajanwari bund	JALORE	Jalore	Luni	Jawai	MINOR	25.303052	72.706093	4.74 M	1020 M	0.15	0.14	-	57.05	-	-	59.00	41.00
2071	Samuja Khadeen	JALORE	Jalore	Luni	Jawai	MINOR	25.385987	72.742721	2.57 M	510 M	0.19	0.12	-	62.37	-	-	27.00	8.00
1986	Chipparwara bund	JALORE	Sayla	Luni	Jawai	MINOR	25.344135	72.360530	5.86 M	1461 M	0.28	0.24	-	90.72	-	53.23	51.95	36.35
2025	Kollar budn	JALORE	Sayla	Luni	Jawai	MINOR	25.372629	72.563189	7.70 M	690 M	0.60	0.53	-	85.00	0.96	214.48	53.00	99.00
2042	Narsana Tank	JALORE	Sayla	Luni	Jawai	MINOR	25.465339	72.580189	4.42	600.00	0.16	0.16	-	72.10	-	46.00	46.00	46.00
2076	Sardar garh bund	JALORE	Sayla	Luni	Jawai	MINOR	25.324296	72.428059	6.73	2,290.00	3.19	3.05	3.78	347.00			821.00	821.00
2078	Sarpatia tank	JALORE	Sayla	Luni	Jawai	MINOR	25.414919	72.483031	5.91	1,080.00	0.26	0.26	-	33.96	135 m.	24.00	24.00	24.00
2097	Torwara bund	JALORE	Sayla	Luni	Jawai	MINOR	25.402374	72.570530	21.00 FT	1065 FT.	0.43	0.39	-	153.22	-	-	44.53	-
2593	Amliya	PALI	Bali	Luni	Jawai	MINOR	24.856274	73.127468				0.95					145.00	
2690	Bisalpur	PALI	Bali	Luni	Jawai	Minor	25.118959	73.182253				0.51					72.50	
2662	Raghunath II	PALI	Bali	Luni	Jawai	MINOR	25.048241	73.128208	7.80	167.00	0.39	0.39	NA	61.35	1,020.00	75.80	62.00	49.50
2663	Raghunathpura I	PALI	Bali	Luni	Jawai	MINOR	25.039733	73.112721	7.30	335.00	0.45	0.45	NA	76.36	1,050.00	103.00	92.00	64.00
2664	Raghunathpura-III Bundh	PALI	Bali	Luni	Jawai	MINOR	25.001093	73.107032				1.06					195.00	
2679	Shvnath Sagar	PALI	Bali	Luni	Jawai	MINOR	25.023860	73.220132	20.10	82.30	1.41	1.42	NA	43.58	900.00	522.00	426.00	240.00
2682	Sohangiri ka Balla	PALI	Bali	Luni	Jawai	MINOR	24.934745	73.264733				0.67					167.00	
2688	Velar Bandh	PALI	Bali	Luni	Jawai	MINOR	24.965734	73.094519	13.00	1,341.00	0.40	0.39	NA	29.20	510.00	-	48.00	25.60
2689	Balwana	PALI	Sumerpur	Luni	Jawai	Minor	25.106275	73.160035	11.42	1,882.72	0.59	0.53		82.70	570 mt		75.22	
2603	Bharunda	PALI	Sumerpur	Luni	Jawai	MINOR	25.196331	73.011915	7.01	3,135.00	12.05	0.34	170.00	1,520.00	-	54.63	55.00	45.73
2615	Galdera Bundh	PALI	Sumerpur	Luni	Jawai	MINOR	25.214137	73.070566	6.39	4,002.00	0.97	0.98		134.69	600M		139.71	
2655	Palri Khera/Puleri Kheda	PALI	Sumerpur	Luni	Jawai	MINOR	25.122952	73.009369	8.00	813.72	1.01	1.07	0.33	4,000.00	5.70	443.72	218.29	152.63
2700	Palri(M)	PALI	Sumerpur	Luni	Jawai	Minor	25.127098	73.012798	6.10	488.00	30.10	0.77	210.00	6,816.00	148 CH	122.37	107.69	88.63
2947	Badgaon	SIROHI	Sheoganj	Luni	Jawai	MINOR	25.108710	73.076156	3.70	1,350.00	1.40	1.40	180.00	258.80	2,500.00	148.58	148.58	126.30
2957	Dhurbana	SIROHI	Sheoganj	Luni	Jawai	MINOR	25.050534	73.052190	9.71	1,255.00	26.76	0.76	190.00	3,024.00	3,000.00	153.79	148.00	65.56
2961	Godana bundh	SIROHI	Sheoganj	Luni	Jawai	MINOR	25.042504	73.046204				1.73					300.00	
2962	Godana Dhurbana	SIROHI	Sheoganj	Luni	Jawai	MINOR	25.042192	73.046193				0.21					38.00	
2973	Krishna Sagar	SIROHI	Sheoganj	Luni	Jawai	MINOR	25.077346	73.105029	4.42	2,075.00	9.75	0.28	190.00	1,545.00	1,000.00	41.28	40.47	40.47
3005	Sukri Innundation	SIROHI	Sheoganj	Luni	Jawai	Minor	25.115716	72.967880				0.07					1,620.00	
	Sub Basin Total										**99.99**	**28.67**				**4,384.27**	**6,054.00**	**2,414.92**
2237	Bhudana Bandh	JODHPUR	Bhopalgarh	Luni	Jojri	MINOR	26.500370	73.503152				0.10					14.52	
2384	Chand Nadi Anicut	JODHPUR	Bhopalgarh	Luni	Jojri	Minor	26.368266	73.397687				0.09					17.00	
2385	Chokidaro wala Bundh	JODHPUR	Bhopalgarh	Luni	Jojri	Minor	26.503802	73.702357				0.24					34.80	
2397	Khajuriyo ki Dhani Anicut	JODHPUR	Bhopalgarh	Luni	Jojri	Minor	26.531382	73.707256				0.11					43.72	
2297	Kosana Anicut	JODHPUR	Bhopalgarh	Luni	Jojri	MINOR	26.446997	73.637767				0.34					49.00	
2298	Kura Bandh	JODHPUR	Bhopalgarh	Luni	Jojri	MINOR	26.330331	73.375717				0.38					120.00	
2403	Madpuria Bundh	JODHPUR	Bhopalgarh	Luni	Jojri	Minor	26.542407	73.709872				0.15					78.10	
2311	Mallar Anicut	JODHPUR	Bhopalgarh	Luni	Jojri	MINOR	26.479079	73.485530				0.08					11.00	
2414	Ratadi Khadeen	JODHPUR	Bhopalgarh	Luni	Jojri	Minor	26.561231	73.579407				0.05					20.00	
2346	Ratria Anicut	JODHPUR	Bhopalgarh	Luni	Jojri	MINOR	26.572333	73.568217				0.07					10.00	
2415	Samo ki Dhani Khadeen	JODHPUR	Bhopalgarh	Luni	Jojri	Minor	26.453144	73.560094				0.11					16.00	
2416	Sathin Anicut	JODHPUR	Bhopalgarh	Luni	Jojri	Minor	26.465984	73.569466				0.18					30.00	
2362	Swamiyonwala Khadeen	JODHPUR	Bhopalgarh	Luni	Jojri	MINOR	26.502778	73.595833				0.29					132.00	
2207	Bala Bandh	JODHPUR	Bilara	Luni	Jojri	MINOR	26.285851	73.590149				0.36					194.00	
2222	Benan Bandh	JODHPUR	Bilara	Luni	Jojri	MINOR	26.318851	73.428248				0.57					82.00	
2242	Birawas Anicut	JODHPUR	Bilara	Luni	Jojri	MINOR	26.260282	73.656940				0.14					20.00	
2247	Chandelao anicut	JODHPUR	Bilara	Luni	Jojri	MINOR	26.246136	73.392363				0.09					13.00	
2260	Garsuria Anicut	JODHPUR	Bilara	Luni	Jojri	MINOR	26.443196	73.734024				0.16					24.69	
2261	Ghana Magra Anicut	JODHPUR	Bilara	Luni	Jojri	MINOR	26.277699	73.613908				0.06					8.00	
2276	Jaliwara bund	JODHPUR	Bilara	Luni	Jojri	MINOR	26.411422	73.591623				4.83					903.49	
2396	Khadi Nadi Anicut	JODHPUR	Bilara	Luni	Jojri	Minor	26.261786	73.478725				0.06					8.00	
2309	Madalia Bandh	JODHPUR	Bilara	Luni	Jojri	MINOR	26.430928	73.706017				0.42					120.00	
2402	Madiya Kalan Khadeen	JODHPUR	Bilara	Luni	Jojri	Minor	26.420392	73.700195				0.09					82.75	
2408	Natwali Nadi Anicut	JODHPUR	Bilara	Luni	Jojri	Minor	26.406518	73.561842				0.06					9.80	
2334	Patel Nagar Bandh-II	JODHPUR	Bilara	Luni	Jojri	MINOR	26.416933	73.846853				0.14					32.39	
2409	Patel Nagar bundh	JODHPUR	Bilara	Luni	Jojri	Minor	26.428785	73.835809				0.05					7.85	
2336	Pipara City Tank	JODHPUR	Bilara	Luni	Jojri	MINOR	26.395460	73.547673				0.38					54.00	
2337	Piplia Bandh	JODHPUR	Bilara	Luni	Jojri	MINOR	26.454213	73.810625				0.51					120.00	
2347	Ravmiyana Anicut	JODHPUR	Bilara	Luni	Jojri	MINOR	26.390335	73.655973				0.08					12.00	
2357	Sindhiyon Ki Dhani II	JODHPUR	Bilara	Luni	Jojri	MINOR	26.237154	73.479724				0.07					20.00	
2226	Bhagtashni Anicut	JODHPUR	Luni	Luni	Jojri	MINOR	26.178295	73.186547				0.26					26.00	
2358	Sirviyo Wala Khadeen	JODHPUR	Luni	Luni	Jojri	MINOR	26.185494	73.275819				0.17					24.28	
2422	Bisalpur Bundh	JODHPUR	Mandor	Luni	Jojri	Minor	26.232203	73.295371				5.82					1,145.00	
2300	Kurnda Anicut	JODHPUR	Mandor	Luni	Jojri	MINOR	26.349110	73.320297				0.13					18.00	
2490	Baman Bund	NAGAUR	Degana	Luni	Jojri	MINOR	26.960266	74.240575				0.06					8.80	

S. No.	Project Name	District	Block	Basin	Sub-basin	Class	Latitude (DD)	Longitude (DD)	Ht. above Lowest Foundation (m)	Length of Dam (m)	Gross Storage Capacity (Mm^3)	Live Storage Capacity (Mm^3)	Reservoir Area at FRL (km^2)	Design Spilway Capacity (cusecs)	Length of Canal System (km)	Command Area (ha)		
																GCA	CCA	ICA
1	2	3	4	5	6	7	9	10	11	12	13	14	15	16	17	18	19	20
2491	Baman deva bund	NAGAUR	Degana	Luni	Jojri	MINOR	27.018899	74.267213				0.05					10.32	
2587	Harsore Bund	NAGAUR	Degana	Luni	Jojri	Minor	26.731355	74.468341	4.57	762.00	2.52	2.52	1.03	1,668.98	5.79	526.11	474.71	343.99
2550	Pachranda Bund-I	NAGAUR	Degana	Luni	Jojri	MINOR	26.708304	74.376581				0.18					13.31	
2551	Pachranda Bund-II	NAGAUR	Degana	Luni	Jojri	MINOR	26.705420	74.368964				0.18					20.30	
2558	Pratapsagar Bund	NAGAUR	Degana	Luni	Jojri	MINOR	26.650367	74.295464				0.21					42.89	
2561	Rajlota Bund	NAGAUR	Degana	Luni	Jojri	MINOR	26.751903	74.429122				0.46					30.13	
2570	Thatarapat	NAGAUR	Degana	Luni	Jojri	MINOR	26.699294	74.461324				0.15					21.46	
2505	Biloo Band-I	NAGAUR	Makrana	Luni	Jojri	MINOR	26.954501	74.644102				0.40					59.73	
2506	Biloo Band-II	NAGAUR	Makrana	Luni	Jojri	MINOR	26.946518	74.660621				0.27					18.35	
2510	Chipolai Bund	NAGAUR	Makrana	Luni	Jojri	MINOR	27.084522	74.769252				0.08					13.36	
2519	Dodiyana Bund	NAGAUR	Makrana	Luni	Jojri	MINOR	26.993965	74.641804	8.73	1,167.38	1.08	0.95		163.68	-	163.90	65.56	75.27
2541	Legokidhani	NAGAUR	Makrana	Luni	Jojri	MINOR	26.951528	74.568630				0.06					8.15	
2589	Mata ji ka Bala IInd	NAGAUR	Makrana	Luni	Jojri	Minor	26.927557	74.446032				0.29					119.83	
2578	Mata ji ka Bala Ist	NAGAUR	Makrana	Luni	Jojri	Minor	26.937121	74.404198				0.37					196.20	
2545	Mataji ka Bala bund	NAGAUR	Makrana	Luni	Jojri	MINOR	26.938873	74.392638				0.37					291.38	
2495	Basni Bund	NAGAUR	Merta	Luni	Jojri	MINOR	26.610490	73.818389				0.46					16.19	
2496	Bayar bund -I	NAGAUR	Merta	Luni	Jojri	MINOR	26.547239	73.920230				0.36					39.25	
2497	Bayar bund -II	NAGAUR	Merta	Luni	Jojri	MINOR	26.524117	73.923293				0.34					40.68	
2507	Bithan Band	NAGAUR	Merta	Luni	Jojri	MINOR	26.500909	73.837777				0.29					32.70	Luni
2581	Dabariyani	NAGAUR	Merta	Luni	Jojri	Minor	26.763474	74.044387				0.22					102.38	
2515	Dhadhasni bund	NAGAUR	Merta	Luni	Jojri	MINOR	26.593724	73.898947				0.22					16.51	
2516	Dhanapa Bund-I	NAGAUR	Merta	Luni	Jojri	MINOR	26.554148	73.735944				0.35					79.97	
2517	Dhanapa Bund-II	NAGAUR	Merta	Luni	Jojri	MINOR	26.541630	73.775164				0.06					9.78	
2521	Gangrana bund	NAGAUR	Merta	Luni	Jojri	MINOR	26.570139	73.905580				2.14					771.20	
2525	Harsolav	NAGAUR	Merta	Luni	Jojri	MINOR	26.659535	73.699510				0.10					6.60	
2530	Kalru bund	NAGAUR	Merta	Luni	Jojri	MINOR	26.731250	73.978933	4.45	539.50	1.48	1.31	2.98	33.75		40.47	343.85	38.98
2535	Kheduli bund	NAGAUR	Merta	Luni	Jojri	MINOR	26.735578	74.009954				0.36					60.25	
2536	Kundal Bund	NAGAUR	Merta	Luni	Jojri	MINOR	26.639295	74.032900				0.35					20.10	
2542	Maliyon ka Dhora Bund	NAGAUR	Merta	Luni	Jojri	MINOR	26.671361	73.945606	2.89	1,228.00	0.32	0.31		74.28	-	205.99	58.66	86.96
2546	Mokal Ghati Bund	NAGAUR	Merta	Luni	Jojri	MINOR	26.632076	73.941675				0.24					46.54	
2547	Mokala bund-I	NAGAUR	Merta	Luni	Jojri	MINOR	26.613482	73.919063				0.46					61.42	
2582	Mokala II	NAGAUR	Merta	Luni	Jojri	Minor	26.614602	73.919517	4.65	1,350.00	0.72	0.94	0.98	167.65		332.26	386.22	269.12
2559	Pundloo bund	NAGAUR	Merta	Luni	Jojri	MINOR	26.509056	73.818081	9.00	280.00	2.71	1.79	1.62	30.28		60.20	624.40	41.68
2566	Satlas Bund	NAGAUR	Merta	Luni	Jojri	MINOR	26.585742	73.865903				0.16					73.98	
2567	Sekhasni Bund	NAGAUR	Merta	Luni	Jojri	MINOR	26.572416	73.932545				0.11					14.44	
2583	Bajwas tank	NAGAUR	Parbatsar	Luni	Jojri	Minor	26.715607	74.599550				0.03					15.00	
2591	Banser	NAGAUR	Parbatsar	Luni	Jojri	Minor	26.637338	74.615764				0.34					149.33	
2493	Banwal Bund-II	NAGAUR	Parbatsar	Luni	Jojri	MINOR	26.618321	74.660475				0.34					115.00	
2498	Bhadasni Bund	NAGAUR	Parbatsar	Luni	Jojri	MINOR	26.676583	74.664107				0.15					14.57	
2499	Bhadasni Bund	NAGAUR	Parbatsar	Luni	Jojri	MINOR	26.676726	74.666128				1.43					60.43	
2584	Bhadiasiya	NAGAUR	Parbatsar	Luni	Jojri	Minor	26.666668	74.666519	7.82	2,895.56	1.45	1.44		127.35	-	2,776.24	237.56	165.52
2500	Bhadwa Bund	NAGAUR	Parbatsar	Luni	Jojri	MINOR	26.876548	74.612093	3.00	905.26	1.22	1.20		115.75	2.13	150.58	81.00	81.00
2585	Bhakari	NAGAUR	Parbatsar	Luni	Jojri	Minor	26.772364	74.512065	6.10	2,072.52	9.27	8.09	5,528.62	868.81	13.07	-	1,927.18	-
2503	Bidiyad Bund	NAGAUR	Parbatsar	Luni	Jojri	MINOR	26.973159	74.687173				0.21					35.54	
2513	Dansriya Bund	NAGAUR	Parbatsar	Luni	Jojri	MINOR	26.927673	74.689621	8.22	2,156.15	0.83	0.50		273.00	2.58	145.28	86.60	86.60
2523	Gullar Bund	NAGAUR	Parbatsar	Luni	Jojri	MINOR	26.856082	74.506992				0.16					28.16	
2524	Harika Naka Bund	NAGAUR	Parbatsar	Luni	Jojri	MINOR	26.919857	74.530272				0.37					68.27	
2574	Jhalra	NAGAUR	Parbatsar	Luni	Jojri	Minor	26.794931	74.690033				2.93					377.58	
2575	Jun ki Ghati	NAGAUR	Parbatsar	Luni	Jojri	Minor	26.918629	74.560117				0.77					125.46	
2528	Kaleda Bund	NAGAUR	Parbatsar	Luni	Jojri	MINOR	26.699193	74.677470				0.28					14.18	
2529	Kaletra Bund	NAGAUR	Parbatsar	Luni	Jojri	MINOR	26.688720	74.675106				0.28					25.40	
2588	Khokhriya	NAGAUR	Parbatsar	Luni	Jojri	Minor	26.673294	74.593578				0.51					185.00	
2537	Kundri Bund	NAGAUR	Parbatsar	Luni	Jojri	MINOR	26.641672	74.566368				0.64					59.73	
2579	Nahri ka Naka	NAGAUR	Parbatsar	Luni	Jojri	Minor	26.793604	74.511746				0.37					168.71	
2553	Paldi Bund	NAGAUR	Parbatsar	Luni	Jojri	MINOR	26.753130	74.568284				0.18					160.00	
2554	Palrikarwa Bund	NAGAUR	Parbatsar	Luni	Jojri	MINOR	26.752715	74.592257				0.18					28.12	
2539	Lampabi Band	NAGAUR	Riyan	Luni	Jojri	MINOR	26.636921	74.195685				0.06					48.16	
2540	Lampolai Bund	NAGAUR	Riyan	Luni	Jojri	MINOR	26.638864	74.177136				0.19					48.16	
2580	Sathana	NAGAUR	Riyan	Luni	Jojri	Minor	26.579693	74.287989				0.69					90.00	
	Sub Basin Total										**21.58**	**55.12**				**4,401.03**	**11,850.13**	**1,189.12**
1978	Bibasar Tanl	JALORE	Jalore	Luni	Khari	MINOR	25.100509	72.597151				1.08					78.50	
1980	Bletala bund	JALORE	Jalore	Luni	Khari	MINOR	25.197989	72.714846	7.465 M	390 M	0.26	0.23	-	63.84	-	-	22.66	22.66
1990	Devada bund	JALORE	Jalore	Luni	Khari	MINOR	25.200039	72.635830	6.03 M	1620 M	0.42	0.37	-	80.65	0.57	94.04	87.44	52.47
1991	Devara bund	JALORE	Jalore	Luni	Khari	MINOR	25.087438	72.634208	5.72	870.00	0.23	0.19	-	71.26	-		54.00	54.00
1993	Dhawala Anicut	JALORE	Jalore	Luni	Khari	MINOR	25.145643	72.653643	4.44 M	390 M	0.16	0.16	-	32.54	-	-	28.50	-
1996	Dudsi bund	JALORE	Jalore	Luni	Khari	MINOR	25.194394	72.671994	6.77 M	1645 M	0.47	0.42	-	81.78	-	-	140.00	-
2112	Jagnathji bund	JALORE	Jalore	Luni	Khari	Minor	25.235910	72.670225				0.37					30.00	

S. No.	Project Name	District	Block	Basin	Sub-basin	Class	Latitude (DD)	Longitude (DD)	Ht. above Lowest Foundation (m)	Length of Dam (m)	Gross Storage Capacity (Mm^3)	Live Storage Capacity (Mm^3)	Reservoir Area at FRL (km^2)	Design Spilway Capacity (cusecs)	Length of Canal System (km)	Command Area (ha)		
																GCA	CCA	ICA
1	2	3	4	5	6	7	9	10	11	12	13	14	15	16	17	18	19	20
2064	Ranap Anicut	JALORE	Jalore	Luni	Khari	MINOR	25.208833	72.748846	3.66 M	1690 M	0.20	0.20	-	50.23	-	-	24.12	24.12
2114	Raniwara bund	JALORE	Jalore	Luni	Khari	Minor	25.211938	72.454097		3497 ft.	0.40	0.40	-	67.92			57.00	57.00
2079	Sawana Khadeen	JALORE	Jalore	Luni	Khari	MINOR	25.054780	72.650365	3.14 M	1417 M	0.10	0.10	-	32.88	-	-	22.00	22.00
2082	Siyana Anicut	JALORE	Jalore	Luni	Khari	MINOR	25.097398	72.670411	4.35 M	1290 M	0.22	0.22	-	43.86	-	-	38.50	31.14 Bed
2083	Siyana Khadeen	JALORE	Jalore	Luni	Khari	MINOR	25.115194	72.673789	2.34 M	810 M	0.30	0.18	-	33.96	-	-	25.00	45.00
1971	Basla Dhanji bund	JALORE	Jaswantpura	Luni	Khari	MINOR	25.144978	72.467350	10.72	2,275.00	0.37	0.33	-	145.71	-		75.27	75.27
1975	Betalana Tank	JALORE	Jaswantpura	Luni	Khari	MINOR	24.939252	72.525663			0.32	0.25	-		-		57.00	57.00
1979	Bithan bund	JALORE	Jaswantpura	Luni	Khari	MINOR	24.947181	72.557373	12.19	575.61	6.39	6.03	9.40	353.75	2.66		752.30	743.60
2041	Mudtarasily Tank	JALORE	Jaswantpura	Luni	Khari	MINOR	25.016110	72.484252	4.50	3504.0 ft	0.73	0.73	-	80.08	-		80.56	56.40
2046	Padra tank	JALORE	Jaswantpura	Luni	Khari	MINOR	24.985183	72.598338	3.82	1,680.00	0.23	0.16	-	57.66		46.00	45.60	44.80
2053	Punak kalla I bund	JALORE	Jaswantpura	Luni	Khari	MINOR	25.001043	72.608173	5.25	1,560.00	0.37	0.33	-	34.90	705.00	80.90	45.30	34.00
2054	Punak kalla II bund	JALORE	Jaswantpura	Luni	Khari	MINOR	24.978955	72.596064	7.50 ft.	1,410.00	0.37	0.33	-	84.98	705.00	105.00	60.00	44.53
2093	Tarwania Bund	JALORE	Jaswantpura	Luni	Khari	MINOR	24.946541	72.546428	21.00 ft.	1450 ft	0.38	0.38	-	47.54	2450 ft.	38.44	26.25	22.25
1962	Alason bund	JALORE	Sayla	Luni	Khari	MINOR	25.321631	72.450339	5.82 M	1210 M	0.42	0.20	-	89.48	-	-	113.00	36.13 bed
1964	Bakra Khadeen	JALORE	Sayla	Luni	Khari	MINOR	25.252348	72.452209	2.25 M	1560 M	0.06	0.06	-	33.96	-	-	24.90	24.90
1988	Dakatra bund	JALORE	Sayla	Luni	Khari	MINOR	25.251789	72.500121	3.10 M	1680 M	0.09	0.09	-	57.93	-	30.00	25.00	25.00
2013	Kallapura bund	JALORE	Sayla	Luni	Khari	MINOR	25.251225	72.536664	7.01	99.39	3.34	3.11	2.23	392.23			456.00	326.00
2944	Akhelao	SIROHI	Sheoganj	Luni	Khari	MINOR	25.040992	72.775707	7.62	137.85	1.78	0.85	1.27	202.09	1.80	380.57	328.00	204.05
2967	Kailash Nagar Dam	SIROHI	Sheoganj	Luni	Khari	MINOR	25.103662	72.827208				1.85					374.00	
2987	Palri K	SIROHI	Sheoganj	Luni	Khari	MINOR	24.990379	72.933815				0.54					143.00	
2950	Barloot	SIROHI	Sirohi	Luni	Khari	MINOR	24.883961	72.712541	10.61	2,730.00	1.53	1.39	0.57	9,744.00	3.25	660.97	637.00	297.63
2953	Chadwal	SIROHI	Sirohi	Luni	Khari	MINOR	24.903036	72.847717	6.10	341.77	0.79	0.77	0.43	5,050.00	1.44	289.07	135.97	49.80
2956	Dhanta	SIROHI	Sirohi	Luni	Khari	MINOR	24.802587	72.843645	13.72	581.09	7.84	7.65	1.93	11,513.00	6.10	1,156.62	1,047.00	762.04
2963	Jawal	SIROHI	Sirohi	Luni	Khari	MINOR	24.989731	72.756298	6.17	2,080.00	0.43	0.43	0.25	2,112.00	0.30	108.50	87.45	70.04
2969	Kameri	SIROHI	Sirohi	Luni	Khari	MINOR	24.930453	72.797438	12.10	2,777.00	7.74	4.18	0.51	56,239.00	5.40	985.43	739.00	738.51
2980	Mandowari Bund	SIROHI	Sirohi	Luni	Khari	MINOR	25.006458	72.700327	3.35	2,052.00	0.87	0.71		74.99	-	205.00	68.79	136.00
2982	Mansarowar	SIROHI	Sirohi	Luni	Khari	MINOR	24.881379	72.889428	7.62	138.07	0.67	0.67			1.62	380.57	95.81	204.05
3007	Nawara	SIROHI	Sirohi	Luni	Khari	Minor	24.979642	72.644888	7.68	1,950.00	0.52	0.48	0.40	5,333.00	1.30	128.85	117.11	117.00
2989	Phacharia	SIROHI	Sirohi	Luni	Khari	MINOR	24.877066	72.629191				1.76					278.00	
2990	Poidra	SIROHI	Sirohi	Luni	Khari	MINOR	24.935778	72.620214	10.41	902.40	3.97	3.42	3.23	10,704.00	5.22	733.31	944.00	385.27
2996	Tawari	SIROHI	Sirohi	Luni	Khari	MINOR	24.880519	72.603619				0.28					51.00	
3002	Varal	SIROHI	Sirohi	Luni	Khari	MINOR	24.883859	72.709045	11.39	1,716.00	1.68	1.56	0.69	184.00	3.00	409.00	296.00	222.18
3003	Velangiri	SIROHI	Sirohi	Luni	Khari	MINOR	24.807795	72.719843				0.54					126.00	
	Sub Basin Total										**43.63**	**42.97**				**5,832.27**	**7,837.03**	**4,917.57**
2595	Bagol Bundh	PALI	Desuri	Luni	Khari (Hemawas)	MINOR	25.379210	73.668705	5.94	79.00	0.26	0.26	NA	101.88	780.00	119.60	48.00	35.60
2639	Kollar Bandh	PALI	Desuri	Luni	Khari (Hemawas)	MINOR	25.414436	73.666710	5.88	24.00	0.74	0.74	NA	47.26	1,050.00	199.60	150.00	104.00
2644	Magartalao Bandh	PALI	Desuri	Luni	Khari (Hemawas)	MINOR	25.405200	73.657067	4.87	949.40	0.28	0.28	NA	14.16	1,355.00	186.00	60.00	59.00
2646	Mamawas Bandh	PALI	Marwar Junction	Luni	Khari (Hemawas)	MINOR	25.533780	73.621291	1.52	5,915.00	0.27	0.27	NA	4,156.00		53.00	50.00	30.00
2668	Renia Bandh	PALI	Marwar Junction	Luni	Khari (Hemawas)	MINOR	25.516995	73.786699	3.96	183.00	0.96	0.96	NA	6,750.00	2.22	162.00	120.00	104.00
2701	Sonia	PALI	Pali	Luni	Khari (Hemawas)	Minor	25.672819	73.371633				0.20					154.00	
	Sub Basin Total										**2.51**	**2.72**				**720.20**	**582.00**	**332.60**
13	Atemand Tank	AJMER	Jawaja	Luni	Luni	MINOR	26.043580	74.328847	NA	340.00	22.00	0.62	NA	1,687.00	3.34	104.00	88.00	71.00
54	Balad (naya)	AJMER	Jawaja	Luni	Luni	MINOR	26.075356	74.352114				2.69					318.00	
55	Balad (old)	AJMER	Jawaja	Luni	Luni	MINOR	26.081339	74.355922				2.69					809.00	
70	Bayale	AJMER	Jawaja	Luni	Luni	MINOR	26.040019	74.352799				0.10					24.00	
82	Bhem Gohane Tank	AJMER	Jawaja	Luni	Luni	MINOR	26.031109	74.282969				0.96					144.00	
116	Daulatgarh Sanga	AJMER	Jawaja	Luni	Luni	MINOR	26.141746	74.355007	NA	770.00	5.88	0.20	NA	1,093.00	0.94	36.00	26.00	16.00
125	Dewatra Tank	AJMER	Jawaja	Luni	Luni	MINOR	25.958831	74.221730	NA	510.00	31.71	0.89	NA	2,055.00	4.72	265.00	223.20	128.00
131	Dhosala Tank	AJMER	Jawaja	Luni	Luni	MINOR	26.100000	74.277778	NA	1,000.00	5.98	0.17	NA	830.00	4.52	80.00	64.00	41.00
132	Dilwara Talab	AJMER	Jawaja	Luni	Luni	MINOR	26.119106	74.366995				2.48					574.00	
154	Gundo Ka Bala	AJMER	Jawaja	Luni	Luni	MINOR	26.029772	74.332462	NA	1,100.00	21.48	0.61	NA	2,904.00	2.54	105.00	88.00	69.00
179	Kabra Tank	AJMER	Jawaja	Luni	Luni	MINOR	25.953451	74.227942	NA	210.00	1.41	1.41	NA	2,262.00	3.58	419.67	332.00	201.00
209	Kherawala (Bhagwanpura)	AJMER	Jawaja	Luni	Luni	MINOR	26.171850	74.302588	NA	240.00	5.10	0.10	NA	1,284.00	1.76	32.00	18.00	16.00
210	Kheri Nalle Khera Tank	AJMER	Jawaja	Luni	Luni	MINOR	26.050281	74.265890				0.10					35.00	
213	Kishanpura Tank	AJMER	Jawaja	Luni	Luni	MINOR	26.044697	74.249527	NA	663.00	7.00	0.20	NA	371.00	1.06	48.00	36.00	23.00
218	Lakania	AJMER	Jawaja	Luni	Luni	MINOR	26.141302	74.405373				0.40					60.00	
235	Makarpura Tank	AJMER	Jawaja	Luni	Luni	MINOR	25.988839	74.224270				3.60					484.00	
392	Naharpura talab	AJMER	Jawaja	Luni	Luni	Minor	25.993404	74.240772	NA	800.00	5.25	0.15	NA	1,091.00	1.30	44.00	35.00	21.00
256	Narbad Khera Talab	AJMER	Jawaja	Luni	Luni	MINOR	26.050000	74.283333	NA	730.00	13.93	0.40	NA	3,146.00	1.94	78.00	64.00	56.00
257	Naya Talab (Anderi Bund)	AJMER	Jawaja	Luni	Luni	MINOR	26.101729	74.403380				0.20					36.00	
286	Parbasli Tank	AJMER	Jawaja	Luni	Luni	MINOR	26.075846	74.263302				0.51					64.00	
308	Rajiawas Tank	AJMER	Jawaja	Luni	Luni	MINOR	26.010016	74.275254	NA	195.00	2.95	2.94	NA	3,896.00	6.88	880.22	696.00	423.00
329	Roher Khera Talab	AJMER	Jawaja	Luni	Luni	MINOR	26.016741	74.232555	NA	590.00	8.96	3.03	NA	634.00	1.76	60.00	48.00	36.00
340	Sarveena Talab	AJMER	Jawaja	Luni	Luni	MINOR	25.991667	74.238889	NA	120.00	17.32	0.49	NA	800.00	14.68	145.00	116.00	70.00
341	Sedriya	AJMER	Jawaja	Luni	Luni	MINOR	26.077778	74.322222	NA	670.00	3.84	0.11	NA	1,036.00	1.30	32.00	24.00	15.00
216	Kundia Talab	AJMER	Masuda	Luni	Luni	MINOR	26.155556	74.411111				0.20					45.00	
241	Markerda Talab	AJMER	Masuda	Luni	Luni	MINOR	26.159151	74.396665				3.60					484.00	

S. No.	Project Name	District	Block	Basin	Sub-basin	Class	Latitude (DD)	Longitude (DD)	Ht. above Lowest Foundation (m)	Length of Dam (m)	Gross Storage Capacity (Mm^3)	Live Storage Capacity (Mm^3)	Reservoir Area at FRL (km^2)	Design Spilway Capacity (cusecs)	Length of Canal System (km)	Command Area (ha)		
																GCA	CCA	ICA
1	2	3	4	5	6	7	9	10	11	12	13	14	15	16	17	18	19	20
303	Purana Talab (Anderi)	AJMER	Masuda	Luni	Luni	MINOR	26.088876	74.382638	6.86	492.00	0.17	0.17	NA	25.23	3.00	28.00	26.00	23.07
344	Shakti Sagar Kharwa	AJMER	Masuda	Luni	Luni	MINOR	26.193381	74.451246	6.67	515.00	3.20	4.90	NA	112.87	6.00	288.00	780.00	106.84
6	Amba Project	AJMER	Peesangan	Luni	Luni	MINOR	26.405828	74.530677				0.35					88.40	
104	Choriswas	AJMER	Peesangan	Luni	Luni	MINOR	26.509227	74.595728				0.17					40.00	
139	Gandharb Sagar	AJMER	Peesangan	Luni	Luni	MINOR	26.385303	74.341749				0.93					180.00	
152	Govindgarh	AJMER	Peesangan	Luni	Luni	MINOR	26.429573	74.380853	NA	4,006.00	4.41	3.68	NA	35,335.00	7.95	704.00	704.00	513.00
160	Human Sagar Kalasara	AJMER	Peesangan	Luni	Luni	MINOR	26.341667	74.433333	NA	1,060.00	31.82	0.70	NA	3,800.00	2.99	284.00	174.40	107.00
176	Jodha Sagar	AJMER	Peesangan	Luni	Luni	MINOR	26.333674	74.321550	NA	470.00	10.00	0.28	NA	1,164.00	2.34	60.00	48.00	32.00
201	Khanpura Tank	AJMER	Peesangan	Luni	Luni	MINOR	26.406094	74.637637	NA	1,110.00	1.12	1.10	NA	13,613.00			110.00	90.00
219	Lakhina Talab	AJMER	Peesangan	Luni	Luni	MINOR	26.307100	74.465983	NA	530.00	14.16	0.40	NA	1,694.00	1.09	76.00	41.00	45.00
244	Modasagar Bhatsuri	AJMER	Peesangan	Luni	Luni	MINOR	26.320031	74.378977	NA	1,730.00	50.00	1.42	NA	5,360.00	2.09	260.00	245.00	162.00
391	Nahardanta karnos	AJMER	Peesangan	Luni	Luni	Minor	26.282682	74.295843	NA	540.00	40.00	1.12	NA	4,756.00	3.81	299.00	201.00	102.00
272	Naya Talab Nad	AJMER	Peesangan	Luni	Luni	MINOR	26.346386	74.371792	NA	2,190.00	25.00	0.71	NA	2,203.00	1.24	162.00	140.00	81.00
291	Phicholia Tank Brichiawas	AJMER	Peesangan	Luni	Luni	MINOR	26.261423	74.558757				0.34					63.50	
296	Phool Sagar Nagelav	AJMER	Peesangan	Luni	Luni	MINOR	26.302190	74.392286	NA	1,680.00	25.00	0.71	NA	2,047.00	5.64	140.00	128.00	80.00
298	Plaundia Brichiawas	AJMER	Peesangan	Luni	Luni	MINOR	26.251313	74.552701				0.34					117.40	
338	Sandolav Bund Nagelov	AJMER	Peesangan	Luni	Luni	MINOR	26.291671	74.416344	NA	1,560.00	19.60	0.43	NA	1,638.00	2.16	89.00	80.00	49.00
343	Shah Sagar Sethan	AJMER	Peesangan	Luni	Luni	MINOR	26.424607	74.414601				0.48					48.00	
354	Shiv Sagar Richanlia	AJMER	Peesangan	Luni	Luni	MINOR	26.426102	74.300114	NA	780.00	18.50	0.44	NA	6,240.00	1.64	80.00	120.00	33.00
374	Tilora	AJMER	Peesangan	Luni	Luni	MINOR	26.528418	74.537361	NA	1,400.00	65.19	2.04	NA	8,100.00	3.62	368.00	291.80	162.00
820	Bajna bund	BARMER	Balotra	Luni	Luni	Minor	25.811499	71.999804	3.00	1,265.00	0.69	0.69	-		-	130.00	130.00	130.00
687	Balujati Khadeen	BARMER	Balotra	Luni	Luni	MINOR	26.281578	72.471099	3.70	420.00	0.61	0.61	-	133.91	-	39.67	39.67	39.67
695	Bhimarlai Khadeen	BARMER	Balotra	Luni	Luni	MINOR	25.818236	71.990250	3.40	1,020.00	0.10	0.10	-	28.85	-	21.00	21.00	21.00
699	Budiwala Khadeen	BARMER	Balotra	Luni	Luni	MINOR	25.692992	72.205451	4.50	1,038.00	0.12	0.12	-	109.31	-	50.20	50.20	50.20
701	chandra bund	BARMER	Balotra	Luni	Luni	MINOR	26.114932	72.573191	5.70	320.00	0.68	0.68	-	106.25	-	-	80.15	80.15
733	Jadisar Khadeen	BARMER	Balotra	Luni	Luni	MINOR	25.953315	72.380992	3.30	1,098.00	0.21	0.21	-	51.77	-	83.80	83.80	83.80
741	Jhadu Charna Anicut	BARMER	Balotra	Luni	Luni	MINOR	26.182496	72.473214				0.68					17.00	
829	Mandali bundh	BARMER	Balotra	Luni	Luni	Minor	26.147853	72.514795	4.50	980.00	0.23	0.23	-	34.24	-	26.72	26.72	26.72
767	Mekharna Khadeen	BARMER	Balotra	Luni	Luni	MINOR	25.840983	72.026130	3.50	1,340.00	0.06	0.06	-	16.97	-	24.00	24.00	24.00
768	Meli bund	BARMER	Balotra	Luni	Luni	MINOR	25.687571	72.139684	7.50	528.50	4.57	4.57	2.83	20.91	4.90	680.00	545.35	408.75
785	Ragawas Khadeen	BARMER	Balotra	Luni	Luni	MINOR	26.183475	72.489389				0.20					26.00	
794	Sarnau kitnod khadeen	BARMER	Balotra	Luni	Luni	MINOR	25.813259	72.348593	3.75	2,022.00	0.32	0.32	-	52.28	-	27.93	27.97	27.93
798	Sinli Khadeen	BARMER	Balotra	Luni	Luni	MINOR	25.756326	72.035099	3.30	1,740.00	0.23	0.23	-	67.89	-	34.00	34.00	34.00
809	Telwara bundh	BARMER	Balotra	Luni	Luni	MINOR	25.901546	72.097012	5.00	525.00	0.35	0.35	-	-	-	69.23	69.23	69.23
810	Thathariya Bandh	BARMER	Balotra	Luni	Luni	MINOR	26.179333	72.564329				0.27					80.00	
811	Thumbli bund	BARMER	Balotra	Luni	Luni	MINOR	26.211729	72.480393	2.33	909.00	0.04	0.04	-	103.00	-	35.00	35.00	35.00
812	Tilwara Khadeen	BARMER	Balotra	Luni	Luni	MINOR	25.864955	72.094517			0.06	0.06					18.00	
839	Trisangari kn. I	BARMER	Balotra	Luni	Luni	Minor	26.076317	72.437559	3.14	2,250.00	0.13	0.13	-	58.05	-	40.08	40.08	40.08
840	Trisangari kn. II	BARMER	Balotra	Luni	Luni	Minor	26.081974	72.436099	3.70	750.00	0.23	0.23	-	19.23	-	39.67	39.67	39.67
816	Varia Khadeen (Tapra)	BARMER	Balotra	Luni	Luni	MINOR	25.722899	72.144926	3.60	1,200.00	0.17	0.17	-	45.82	-	20.00	20.00	20.00
841	Varia anicut	BARMER	Balotra	Luni	Luni	Minor	25.791356	72.106654	8.50	295.00	0.00	0.18	-	16.97	-		20.00	
678	Agroe Magrewala Khadeen	BARMER	Barmer	Luni	Luni	MINOR	25.790985	71.385979	3.60	1,206.00	0.08	0.08	-	38.19	-	26.30	26.30	26.30
819	Ati bund	BARMER	Barmer	Luni	Luni	Minor	25.666323	71.332836	5.20	475.00	0.31	0.31	-	141.01	-	112.10	112.10	112.10
681	Bagjiwala Khadeen	BARMER	Barmer	Luni	Luni	MINOR	25.833188	71.408210	2.75	1,575.00	0.08	0.08	-	84.33	-	7.70	7.70	7.70
682	Baisala Khadeen	BARMER	Barmer	Luni	Luni	MINOR	25.895209	71.264197	2.45	516.00	0.08	0.08	-	84.61	-	39.70	39.70	39.70
684	Balera bund	BARMER	Barmer	Luni	Luni	MINOR	25.623628	71.289279	5.20	1,400.00	0.46	0.46	-	283.16	-	115.00	115.00	115.00
685	Balera Khadeen	BARMER	Barmer	Luni	Luni	MINOR	25.625420	71.296187	2.70	428.00	0.06	0.06	-	40.72	-	17.00	17.00	17.00
686	Balera Khadeen	BARMER	Barmer	Luni	Luni	MINOR	25.629973	71.287032	3.39	1,066.00	0.13	0.13	-	50.80	-	-	10.00	10.00
706	Chuli anicut	BARMER	Barmer	Luni	Luni	MINOR	25.808834	71.348479	5.20	150.00	0.03	0.03	-	14.15	-	10.50	10.50	10.50
707	Chuli Khadeen	BARMER	Barmer	Luni	Luni	MINOR	25.818677	71.365039	3.00	1,237.00	0.06	0.06	-	42.40	-	7.60	7.60	7.60
708	Chuli Magrewala Khadeen	BARMER	Barmer	Luni	Luni	MINOR	25.825339	71.355799	2.49	1,860.00	0.09	0.09	-	49.80	-	8.00	8.00	8.00
720	Gehku Khadeen	BARMER	Barmer	Luni	Luni	MINOR	25.764634	71.378244	3.65	805.00	0.11	0.11	-	48.22	-	23.00	23.00	23.00
736	Jalipa Khadeen	BARMER	Barmer	Luni	Luni	MINOR	25.827610	71.392916	3.30	567.00	0.10	0.10	-	72.19	-	30.35	30.35	30.35
737	Jana Patrasar Khadeen	BARMER	Barmer	Luni	Luni	MINOR	25.640081	71.252569			0.10	0.10					8.00	
738	Jasai Khadeen	BARMER	Barmer	Luni	Luni	MINOR	25.716818	71.238877	3.80	337.00	0.07	0.07	-	47.68	-	-	8.70	8.70
743	Joshiyawala Kn.	BARMER	Barmer	Luni	Luni	MINOR	25.501791	71.397871	3.50	990.00	0.07	0.07	-	16.97	-	18.20	18.20	18.20
745	Kaliyar Khadeen	BARMER	Barmer	Luni	Luni	MINOR	25.916957	71.314398	71 19 00	608.00	0.12	0.12	-	31.11	-	40.10	40.10	40.10
761	Lunu bundh	BARMER	Barmer	Luni	Luni	MINOR	25.800721	71.310650	3.80	910.00	0.12	0.12	-	128.70	-	59.00	59.00	59.00
769	Mithri Khadeen Jasai	BARMER	Barmer	Luni	Luni	MINOR	25.642498	71.166206	4.40	540.00	0.08	0.08	-	59.98	-	13.40	13.40	13.40
786	Ramalwala Khadeen	BARMER	Barmer	Luni	Luni	MINOR	25.708197	71.315714	2.50	451.00	0.16	0.16	-	43.44	-	-	14.60	14.60
787	Ramderia Khadeen	BARMER	Barmer	Luni	Luni	MINOR	25.543441	71.346199	5.50	7.25	0.03	0.03	-	58.01	-	27.00	27.00	27.00
789	Ranigaon Khadeen	BARMER	Barmer	Luni	Luni	MINOR	25.586725	71.314175	3.40	630.00	0.08	0.08	-	65.10	-	9.80	9.80	9.80
837	Talarwala khadeen (Sonri)	BARMER	Barmer	Luni	Luni	Minor	25.945358	71.292408	2.05	870.00	0.10	0.10	-	52.35	-	7.10	7.10	7.10
806	Tarata Anicut	BARMER	Barmer	Luni	Luni	MINOR	25.550102	71.261747	4.00	125.00	0.07	0.07	-	31.69	-	11.20	11.20	11.20
807	Taratra Bund	BARMER	Barmer	Luni	Luni	MINOR	25.538690	71.259143	4.00	777.00	0.10	0.10	-	74.75	-	24.10	24.10	24.10
808	Taratra Khadeen	BARMER	Barmer	Luni	Luni	MINOR	25.529007	71.256552	3.70	1,195.00	0.05	0.05	-	83.82	-	19.50	19.50	19.50
677	Achlewala Khadeen	BARMER	Baytoo	Luni	Luni	MINOR	25.853352	71.471930	2.85	870.00	0.06	0.06	-	18.64	-	4.00	4.00	4.00

S. No.	Project Name	District	Block	Basin	Sub-basin	Class	Latitude (DD)	Longitude (DD)	Ht. above Lowest Foundation (m)	Length of Dam (m)	Gross Storage Capacity (Mm^3)	Live Storage Capacity (Mm^3)	Reservoir Area at FRL (km^2)	Design Spilway Capacity (cusecs)	Length of Canal System (km)	Command Area (ha)		
																GCA	CCA	ICA
1	2	3	4	5	6	7	9	10	11	12	13	14	15	16	17	18	19	20
688	Balwantsingh Ka Khadeen	BARMER	Baytoo	Luni	Luni	MINOR	26.082260	71.749292	3.00	728.00	0.08	0.08	-	29.32	-	24.62	24.62	24.62
689	Bandra bund	BARMER	Baytoo	Luni	Luni	MINOR	25.805811	71.440884	2.85	1,107.50	0.12	0.12		137.08	-	37.00	37.00	37.00
696	Bhimjiwala Khadeen	BARMER	Baytoo	Luni	Luni	MINOR	25.849016	71.450697	3.30	211.00	0.09	0.09	-	28.85	-	20.65	20.65	20.65
713	Devawala Khadeen	BARMER	Baytoo	Luni	Luni	MINOR	25.889213	71.404212	4.00	1,310.00	0.16	0.16	-	52.93	-	29.15	29.15	29.15
723	Gordhanwala Khadeen	BARMER	Baytoo	Luni	Luni	MINOR	25.833572	71.438947	3.50	750.00	0.02	0.02	-	10.04	-	48.60	48.60	48.60
731	Holi ka Magra Khadeen	BARMER	Baytoo	Luni	Luni	MINOR	25.748924	71.502118	2.50	875.00	0.07	0.07	-	46.08	-	22.90	22.90	22.90
734	Jalandari Khadeen	BARMER	Baytoo	Luni	Luni	MINOR	25.884373	71.394307	3.10	735.00	0.18	0.18	-	71.28	-	43.30	43.30	43.30
827	Kesumbla khadeen	BARMER	Baytoo	Luni	Luni	Minor	26.327787	71.797583	2.40	810.00	0.10	0.10	-	33.62	-	14.00	14.00	14.00
752	Khatriyo ka Khadeen	BARMER	Baytoo	Luni	Luni	MINOR	25.931223	71.527305	1.85	430.00	0.03	0.03	-	18.80	-	5.00	5.00	5.00
755	Khumansingh ka Khadeen	BARMER	Baytoo	Luni	Luni	MINOR	26.145713	71.861602	2.15	-	0.09	0.09	-	65.37	-	5.90	5.90	5.90
757	Koisa Khadeen	BARMER	Baytoo	Luni	Luni	MINOR	25.947128	71.673116	4.00	1,923.00	0.12	0.12	-	51.34	-	31.00	31.00	31.00
759	Kumto tal Khadeen (Bhimada)	BARMER	Baytoo	Luni	Luni	MINOR	26.030727	71.576702	3.00	1,235.00	0.10	0.10	-	82.86	-	34.00	34.00	34.00
765	Meghwalo ka Khadeen (Harsani)	BARMER	Baytoo	Luni	Luni	MINOR	25.863667	71.587102	2.30	1,010.00	0.13	0.13	-	96.40	-	35.18	35.18	35.18
766	Meghwalo ka khadeen (Pubuseria)	BARMER	Baytoo	Luni	Luni	MINOR	26.127306	71.891594	1.90	685.00	0.05	0.05	-	27.90	-	9.10	9.10	9.10
771	Muindo ka Khadeen (Bandra)	BARMER	Baytoo	Luni	Luni	MINOR	25.818878	71.429700			0.12	0.12					11.20	
783	Purohitan Khadeen I	BARMER	Baytoo	Luni	Luni	MINOR	25.842248	71.426166	3.50	1,218.00	0.09	0.09	-	22.49	-	16.20	16.20	16.20
784	Purohitan Khadeen II	BARMER	Baytoo	Luni	Luni	MINOR	25.840701	71.420836	3.30	1,158.00	0.19	0.19	-	15.27	-	13.20	13.20	13.20
799	Sutharonwala Khadeen	BARMER	Baytoo	Luni	Luni	MINOR	25.946073	71.370382	4.10	360.00	0.11	0.11	-	44.34	-	26.00	26.00	26.00
813	Tora Khadeen	BARMER	Baytoo	Luni	Luni	MINOR	25.833333	71.450000	4.10	1,340.00	0.12	0.12	-	32.59	-	27.90	27.90	
705	Chohtan anicut	BARMER	Chohtan	Luni	Luni	MINOR	25.476058	71.097739	4.40	365.00	0.03	0.03	-	34.04	-	6.70	6.70	6.70
717	Dingra Anicut	BARMER	Chohtan	Luni	Luni	MINOR	25.289940	71.064779	7.06	90.50	0.02	0.02	-	27.55	-	4.80	4.80	4.80
735	Jaleta Khadeen I	BARMER	Chohtan	Luni	Luni	MINOR	25.089528	70.971403	2.10	1,110.00	0.08	0.08	-	58.88	-	12.00	12.00	12.00
691	Bhakarpura bund	BARMER	Dhorimanna	Luni	Luni	MINOR	25.153477	71.770016	5.00	2,657.90	0.86	0.86	-	22.49	-	123.00	123.00	123.00
692	Bhilon wala Khadeen (Gehun)	BARMER	Dhorimanna	Luni	Luni	MINOR	25.273759	71.219825	4.60	365.00	0.27	0.27	-	62.18	-	22.50	22.50	22.50
693	Bhilonwala Khadeen (Dharuda)	BARMER	Dhorimanna	Luni	Luni	MINOR	25.267295	71.218009	3.50	725.00	0.13	0.13	-	67.05	-	24.20	24.20	24.20
694	Bhilowala Khadeen	BARMER	Dhorimanna	Luni	Luni	MINOR	25.264099	71.229464	3.80	480.00	0.06	0.06	-	84.53	-	21.00	21.00	21.00
700	Bularam Muknewala Khadeen	BARMER	Dhorimanna	Luni	Luni	MINOR	25.044775	71.533243	2.80	660.00	0.08	0.08	-	40.98	-	21.00	21.00	21.00
824	Dhangaria bund	BARMER	Dhorimanna	Luni	Luni	Minor	25.075825	71.707219	2.00	1,565.00	0.50	0.50	-	57.25	-	156.00	156.00	156.00
722	Goliya bund	BARMER	Dhorimanna	Luni	Luni	MINOR	25.194429	71.720415	2.80	1,970.00	0.84	0.84	-	79.20	-	271.00	271.00	271.00
760	Lakheria bund	BARMER	Dhorimanna	Luni	Luni	MINOR	25.226442	71.776475	3.00	624.00	0.20	0.20	-		-	60.00	60.00	60.00
764	Meghwalo ka Khadeen (Gunga)	BARMER	Dhorimanna	Luni	Luni	MINOR	25.239805	71.803804	2.50	870.00	0.14	0.14	-	45.00	-	38.00	38.00	38.00
797	Sindhaswa bund	BARMER	Dhorimanna	Luni	Luni	MINOR	25.154203	71.743141	3.00	1,270.00	1.90	1.90	-	88.71	-	156.00	156.00	156.00
815	Udasar Khadeen	BARMER	Dhorimanna	Luni	Luni	MINOR	25.328535	71.539252	3.10	1,250.00	0.07	0.07	-	68.10	-	6.90	6.90	6.90
679	Akoli Khadeen	BARMER	Sheo	Luni	Luni	MINOR	26.033695	71.213870	2.30	830.00	0.09	0.09	-	51.56	-	14.00	14.00	14.00
680	Arang khadeen	BARMER	Sheo	Luni	Luni	MINOR	26.455873	71.528962	2.35	1,735.00	0.06	0.06	-	35.09	-	39.67	39.67	39.67
683	Bala bund	BARMER	Sheo	Luni	Luni	MINOR	26.260261	71.378647	2.10	870.00	0.07	0.07	-	28.24	-	19.00	19.00	19.00
704	Chochra Khadeen	BARMER	Sheo	Luni	Luni	MINOR	26.443713	71.471896	3.10	1,255.00	0.21	0.21	-	89.67	-	9.00	9.00	9.00
714	Devika Khadeen	BARMER	Sheo	Luni	Luni	MINOR	26.405063	71.228782	3.00	1,845.00	0.22	0.21	-	80.85	-	38.00	38.00	38.00
727	Gunga Khadeen II	BARMER	Sheo	Luni	Luni	MINOR	26.274168	71.243487	2.35	1,830.00	0.10	0.10	-	78.71	-	25.29	25.29	25.29
739	Jasse ka Gaon Khadeen	BARMER	Sheo	Luni	Luni	MINOR	26.186590	71.201705	3.30	840.00	0.06	0.06	-	41.37	-	16.20	16.20	16.20
758	Kotra Khadeen I	BARMER	Sheo	Luni	Luni	MINOR	26.153814	71.214745	2.60	1,100.00	0.11	0.11	-	49.52	-	14.00	14.00	14.00
828	Kotra khadeen III	BARMER	Sheo	Luni	Luni	Minor	26.154944	71.204031	2.56	7.33	0.06	0.06	-	98.94	-	28.12	28.12	28.12
833	Nagarda khadeen	BARMER	Sheo	Luni	Luni	Minor	26.153974	71.403055	3.90	1,663.00	0.18	0.18	-	49.92	-	27.00	27.00	27.00
774	Nimla Khadeen	BARMER	Sheo	Luni	Luni	MINOR	26.071005	71.318028	16.50	471.50	0.31	0.31	-	45.28	-	32.80	32.80	32.80
781	Posalia Khadeen	BARMER	Sheo	Luni	Luni	MINOR	26.175645	71.474080	3.60	1,510.00	0.10	0.10	-	74.99	-	25.00	25.00	25.00
835	Rathkudia khadeen	BARMER	Sheo	Luni	Luni	Minor	26.464465	71.505092	3.50	1,185.00	0.10	0.10	-	45.00	-	8.00	8.00	8.00
791	Reotonia ki Dhani Khadeen	BARMER	Sheo	Luni	Luni	MINOR	26.159932	71.177588	2.20	690.00	0.09	0.09	-	41.60	-	16.00	16.00	16.00
795	Savitri bund	BARMER	Sheo	Luni	Luni	MINOR	26.100550	71.410425	3.23	1,388.00	0.08	0.08	-	123.00	-	46.00	46.00	46.00
801	Suwala khadeen	BARMER	Sheo	Luni	Luni	MINOR	26.099018	71.121079	2.40	1,080.00	0.05	0.05	-	58.64	-	11.00	11.00	11.00
802	Tajaram ka Khadeen (Kashmer)	BARMER	Sheo	Luni	Luni	MINOR	26.308217	71.557695	2.40	455.00	0.11	0.11	-	35.06	-	21.05	21.05	21.05
690	Bhadwa bund Dundali	BARMER	Sindhari	Luni	Luni	MINOR	25.704691	71.921693	3.50	860.00	0.10	0.10	-	40.41	-	17.00	17.00	17.00
697	Bisodund Khadeen	BARMER	Sindhari	Luni	Luni	MINOR	25.389044	71.482179	3.80	1,920.00	0.19	0.19	-	51.34	-	53.40	53.40	53.40
823	Devera kn. (Karna)	BARMER	Sindhari	Luni	Luni	Minor	25.740507	71.985910	2.50	480.00	0.05	0.05	-	53.63	-	20.34	20.34	20.34
721	Ghatowala Trisulia Khadeen	BARMER	Sindhari	Luni	Luni	MINOR	25.727539	71.798546	2.60	840.00	0.06	0.06	-	16.97	-	24.00	24.00	24.00
730	Hodu bund	BARMER	Sindhari	Luni	Luni	MINOR	25.608580	71.753870	4.50	600.00	0.15	0.15	-	51.81	-	32.00	32.00	32.00
732	Hukmania Khadeen	BARMER	Sindhari	Luni	Luni	MINOR	25.490896	71.551379	4.10	615.00	0.13	0.13	-	19.23	-	31.00	31.00	31.00
749	Karalinadi Khadeen	BARMER	Sindhari	Luni	Luni	MINOR	25.547977	71.813228	2.70	540.00	0.09	0.09	-	22.41	-	20.00	20.00	20.00
754	Khudal Khadeen	BARMER	Sindhari	Luni	Luni	MINOR	25.389354	71.788406	2.80	890.00	0.06	0.06	-	37.64	-	22.00	22.00	22.00
772	Nakoda Khadeen	BARMER	Sindhari	Luni	Luni	MINOR	25.511065	71.878438	3.30	1,055.00	0.70	0.70	-	52.28	-	100.00	100.00	100.00
775	Nokhari Khadeen (Sanpha)	BARMER	Sindhari	Luni	Luni	MINOR	25.488200	71.632141	2.10	725.00	0.07	0.07	-	30.81	-	11.00	11.00	11.00
776	Nosar Anicut (Nosar)	BARMER	Sindhari	Luni	Luni	MINOR	25.801388	71.867165	4.80	180.00	0.06	0.06	-	37.21	-	14.00	14.00	14.00
778	Parmaniya Khadeen	BARMER	Sindhari	Luni	Luni	MINOR	25.790834	71.785307	3.10	980.00	0.06	0.06	-	60.70	-	22.00	22.00	22.00
792	Sanapa bund	BARMER	Sindhari	Luni	Luni	MINOR	25.714379	71.849058	3.45	1,029.00	0.11	0.11	-	143.90	-	55.00	55.00	55.00
793	Sanpha Anicut	BARMER	Sindhari	Luni	Luni	MINOR	25.713169	71.834961	2.70	280.00	0.06	0.06	-	33.39	-	I.B.	8.32	I.B.
836	Samu khadeen	BARMER	Sindhari	Luni	Luni	Minor	25.670202	71.783357	2.80	574.00	0.05	0.05	-	1.38	-	19.00	19.00	19.00
796	Sherejat wala Khadeen	BARMER	Sindhari	Luni	Luni	MINOR	25.773458	71.753463	3.00	840.00	0.06	0.06	-	69.12	-	23.00	23.00	23.00
800	Sutharowala Khadeen	BARMER	Sindhari	Luni	Luni	MINOR	25.478268	71.677763	3.60	390.00	0.11	0.11	-	44.32	-	20.10	20.10	20.10

S. No.	Project Name	District	Block	Basin	Sub-basin	Class	Latitude (DD)	Longitude (DD)	Ht. above Lowest Foundation (m)	Length of Dam (m)	Gross Storage Capacity (Mm^3)	Live Storage Capacity (Mm^3)	Reservoir Area at FRL (km^2)	Design Spilway Capacity (cusecs)	Length of Canal System (km)	Command Area (ha)		
																GCA	CCA	ICA
1	2	3	4	5	6	7	9	10	11	12	13	14	15	16	17	18	19	20
803	Taku beri Anciut	BARMER	Sindhari	Luni	Luni	MINOR	25.653082	71.849235	3.50	430.00	0.06	0.06	-	36.84	-	10.00	10.00	10.00
838	Thatiya khadeen	BARMER	Sindhari	Luni	Luni	Minor	25.368619	71.832501	1.95	840.00	0.06	0.06	-	16.97	-	24.30	24.30	24.30
709	Dabla Khadeen	BARMER	Siwana	Luni	Luni	MINOR	25.654213	72.635793	4.20	975.00	0.06	0.06	-	21.84	-	34.40	34.40	34.40
822	Dantala anicut	BARMER	Siwana	Luni	Luni	Minor	25.666206	72.462911	3.45	230.00	0.01	0.01	-	12.37	-	-	1.74	-
715	Devra Khadeen I	BARMER	Siwana	Luni	Luni	MINOR	25.729757	72.524966	3.84	1,495.00	0.16	0.16	-	64.16	-	-	1.76	-
716	Devra Khadeen II	BARMER	Siwana	Luni	Luni	MINOR	25.735478	72.531271	2.80	1,107.00	0.04	0.04	-	30.78	-	-	1.58	-
825	Dheera anicut I	BARMER	Siwana	Luni	Luni	Minor	25.531858	72.454356	5.15	97.50	0.03	0.03	-	28.29	-	-	4.98	-
826	Dheera anicut II	BARMER	Siwana	Luni	Luni	Minor	25.522465	72.453047	3.70	204.00	0.09	0.09	-	55.75	-	-	12.83	-
726	Gudanal bund I	BARMER	Siwana	Luni	Luni	MINOR	25.617723	72.344406	3.75	1,026.00	0.19	0.19	-	90.97	-	56.93	56.93	56.93
756	Kitnod bund	BARMER	Siwana	Luni	Luni	MINOR	25.689829	72.409678	5.30	90.00	0.29	0.29	-	102.43	-	83.80	83.80	83.80
762	Mangi Anicut II	BARMER	Siwana	Luni	Luni	MINOR	25.529847	72.426781	6.05	417.50	0.17	0.17	-	44.92	-	-	6.09	-
763	Mawari bund	BARMER	Siwana	Luni	Luni	MINOR	25.612500	72.483333	7.00	530.00	0.32	0.32	-	64.89	1.20	81.14	81.14	81.14
831	Mokalsar khadeen	BARMER	Siwana	Luni	Luni	Minor	25.597096	72.543178	3.00	1,325.00	0.06	0.06					7.92	
770	Motisara Khadeen (Mungeria)	BARMER	Siwana	Luni	Luni	MINOR	25.654213	72.635793	4.20	975.00	0.06	0.05	-	21.84	-	34.40	25.10	34.40
832	Muknowala kn.	BARMER	Siwana	Luni	Luni	Minor	25.854865	72.547846	3.85	600.00	0.07	0.07	-	77.34	-	19.60	19.60	19.60
773	Naneri Vagunda bund	BARMER	Siwana	Luni	Luni	MINOR	25.589156	72.412530	6.65	1,008.00	0.75	0.75	-	183.02	-	150.00	150.00	150.00
780	Phoolan bund	BARMER	Siwana	Luni	Luni	MINOR	25.705556	72.533333	4.00	1,030.00	0.08	0.08	-	77.35	-	50.00	30.00	22.00
834	Piplun bund	BARMER	Siwana	Luni	Luni	Minor	25.591642	72.373484	5.35	1,213.00	0.49	0.49	-	140.40	-	73.60	73.68	73.60
788	Ramsar ka nada Khadeen	BARMER	Siwana	Luni	Luni	MINOR	25.847581	72.709245	2.85	1,046.00	0.14	0.14	-	11.31	-	59.50	59.50	59.50
805	Talwarwala Khadeen II (Chuli)	BARMER	Siwana	Luni	Luni	MINOR	25.476478	72.404313	2.45	670.00	0.08	0.08	-	49.75	-	17.60	17.60	17.60
814	Tuti Anicut	BARMER	Siwana	Luni	Luni	MINOR	25.573176	72.490005	6.70	259.00	0.07	0.07	-	48.09	-	-	6.06	
817	Vaya Anicut	BARMER	Siwana	Luni	Luni	MINOR	25.595498	72.544478	8.04	254.00	0.02	0.02	-	16.97	-	-	22.07	
1966	Bala Bund	JALORE	Ahore	Luni	Luni	MINOR	25.618402	72.759352	5.63 M	3120 M	0.69	0.66	-	88.30	-	112.00	94.00	79.00
1967	Bala khadeen I	JALORE	Ahore	Luni	Luni	MINOR	25.638100	72.732703	1.90 M	1080 M	0.15	0.15	-	46.12	-	-	21.50	-
1968	Bala Khadeen II	JALORE	Ahore	Luni	Luni	MINOR	25.616338	72.754460	2.65 M	780 M	0.14	0.14	-	43.86	-	-	20.00	-
2043	Neelkanth Khadeen	JALORE	Ahore	Luni	Luni	MINOR	25.651682	72.714134	2.15 M	1150 M	0.05	0.05	-	36.47	-	-	7.50	-
2061	Rama Khadeen	JALORE	Ahore	Luni	Luni	MINOR	25.632277	72.829933	4.70 M	2135 M	0.42	0.42	-	69.34	-	-	41.68	41.68
2089	Sureshwarji bund	JALORE	Ahore	Luni	Luni	MINOR	25.462890	72.720517	7.30 M	480 M	0.25	0.21	-	52.84	-	-	63.00	63.00
1959	Agarwa X bund	JALORE	Chitalwana	Luni	Luni	MINOR	24.938846	71.533597			0.18	0.18	-		-	-	28.50	28.50
1961	Akodia X bund	JALORE	Chitalwana	Luni	Luni	MINOR	24.709744	71.233201	4.20	2,310.00	0.67	0.67	-	374.60	-	-	157.50	157.50
1963	Amarpura X bund	JALORE	Chitalwana	Luni	Luni	MINOR	24.988875	71.800177		1520 ft	0.18	0.16	-	32.83	-	-	32.00	32.00
1969	Balera X bund	JALORE	Chitalwana	Luni	Luni	MINOR	24.726430	71.475273	5.84	2,535.00	1.26	0.94	4.05				426.00	426.00
1976	Bhadrun X bund	JALORE	Chitalwana	Luni	Luni	MINOR	24.810088	71.511402	2.65	2,440.00	1.59	1.09	15.75				342.10	342.10
2110	Bhatki X bund	JALORE	Chitalwana	Luni	Luni	Minor	24.705961	71.463558	4.50	500.00		0.52	-		-	-	30.00	22.00
1987	Chittalwana X bund	JALORE	Chitalwana	Luni	Luni	MINOR	24.938277	71.639466	6.78	5,890.00	12.24	11.15	30.78			1,926.34	1,903.60	1,903.60
1994	Dhingpura X bund	JALORE	Chitalwana	Luni	Luni	MINOR	24.730396	71.413214			0.28	0.25	-		-	-	103.20	
1997	Duthwa X bund-I	JALORE	Chitalwana	Luni	Luni	MINOR	24.879452	71.500240	5.00	219.51	3.40	3.10	7.27				720.00	720.00
1998	Duthwa X bund-II	JALORE	Chitalwana	Luni	Luni	MINOR	24.880212	71.500915	5.79	1,880.00	2.26	2.26	14.63				619.80	619.80
1999	Galifa X bund	JALORE	Chitalwana	Luni	Luni	MINOR	24.838868	71.560749	5.79	121.95	2.12	2.12	6.81				400.00	400.00
2000	Gandhav X bund	JALORE	Chitalwana	Luni	Luni	MINOR	24.986437	71.672064		27.00	1.43	1.43	-	68.26	-	-	118.60	188.60
2003	Hemaguda II x bund	JALORE	Chitalwana	Luni	Luni	MINOR	24.982488	71.713478	11.27	5350 ft	2.77	2.77	-	163.29	-	-	627.27	627.27
2005	Hotigaon X bund I	JALORE	Chitalwana	Luni	Luni	MINOR	24.855639	71.566679	6.10	121.95	1.98	1.78	5.83				404.00	400.00
2006	Hotigaon X bund II	JALORE	Chitalwana	Luni	Luni	MINOR	24.878418	71.569704			0.98	0.98	-		-	-	151.00	151.00
2012	Kabuli Ki dhani X bund	JALORE	Chitalwana	Luni	Luni	MINOR	24.921532	71.397599	6.00 ft	1150 ft	0.08	0.29	-		-	-	100.00	19.50
2016	Kapooria X Bund	JALORE	Chitalwana	Luni	Luni	MINOR	24.968164	71.697906	7.00	4,680.00	3.24	3.17	9.28				427.90	427.90
2019	Keria X bund	JALORE	Chitalwana	Luni	Luni	MINOR	24.963034	71.640599	6.70	4,365.00	8.16	7.77	21.07				406.50	406.50
2020	Kesari X bund	JALORE	Chitalwana	Luni	Luni	MINOR	24.763118	71.496879	7.30	182.56	3.45	3.45	8.48				598.80	598.80
2023	Khejadiyali X bund I	JALORE	Chitalwana	Luni	Luni	MINOR	24.777459	71.288988	9.36 ft	3,048.00	1.13	1.13		243.38	-	-	191.00	242.91
2024	Khejdiyali II X bund	JALORE	Chitalwana	Luni	Luni	MINOR	24.764441	71.273087	4.90	1,410.00	0.85	0.81	-	382.21	-	-	190.00	190.00
2027	Kukaria X bund	JALORE	Chitalwana	Luni	Luni	MINOR	24.665564	71.331299	4.87	2,485.00	2.75	1.52	11.36				324.70	324.70
2035	Malasar X bund	JALORE	Chitalwana	Luni	Luni	MINOR	24.899402	71.763928	15.92 ft	7200 ft	0.57	0.57	-	26.40	-	-	129.55	129.55
2040	Methaki Khal X bund	JALORE	Chitalwana	Luni	Luni	MINOR	24.773315	71.347277	4.28	2,310.00	3.03	2.63	4.30				578.15	578.15
2050	Pavta Bhatwas X bund	JALORE	Chitalwana	Luni	Luni	MINOR	24.834904	71.463813	4.98	2,675.00	1.08	1.08	-	495.42	-	-	140.00	233.00
2052	Phogarwa X bund	JALORE	Chitalwana	Luni	Luni	MINOR	24.801172	71.431183	6.10	1,410.00	2.05	2.05	6.15				395.50	395.50
2062	Rampura Tantara bund	JALORE	Chitalwana	Luni	Luni	MINOR	25.078093	71.815420	4.50 m	840.00	0.46	0.46	-	182.53	-	-	30.00	75.00
2063	Rampura X bund	JALORE	Chitalwana	Luni	Luni	MINOR	25.101135	71.810024	7.05	2,320.00	5.32	3.73	7.23				549.80	549.80
2115	Ranodar I X bund	JALORE	Chitalwana	Luni	Luni	Minor	24.958710	71.697970	22.50 ft	6250 ft	4.25	4.25	-	1,138.00	-	-	35.00	800.00
2066	Ranodar II X bund	JALORE	Chitalwana	Luni	Luni	MINOR	24.970384	71.729750			0.35	0.35					32.50	32.50
2067	Ranodar III X bund	JALORE	Chitalwana	Luni	Luni	MINOR	24.958562	71.700850		1,200.00	-	0.87					27.00	27.00
2068	Ratanpura X bund	JALORE	Chitalwana	Luni	Luni	MINOR	24.894393	71.654881	6.63	158.49	2.12	1.20	5.77				434.00	519.85
2069	Ridha X bund	JALORE	Chitalwana	Luni	Luni	MINOR	24.727059	71.316320				0.96					187.45	
2074	Sankaria X bund	JALORE	Chitalwana	Luni	Luni	MINOR	24.780782	71.355391	6.63	147.50	2.20	2.20	6.37				483.80	483.80
2084	Suja ki Khal X Bund	JALORE	Chitalwana	Luni	Luni	MINOR	24.689528	71.398677	12.98 ft	6200 ft	0.86	0.66	-	245.93	-	-	182.12	182.12
2085	Sujanpura X bund	JALORE	Chitalwana	Luni	Luni	MINOR	24.807631	71.454803	5.50	1,120.00	6.60	0.49	-	180.00	-	-	55.00	133.00
2086	Surachand I X bund	JALORE	Chitalwana	Luni	Luni	MINOR	24.823699	71.401459	16.78 ft	4200 ft	1.13	1.13	-	226.40	-	-	127.00	242.90
2087	Surachand II X bund	JALORE	Chitalwana	Luni	Luni	MINOR	24.823021	71.412753	3.82	2,190.00	0.57	0.57	-	76.12	-	-	127.93	127.93
2090	Suthri II X bund	JALORE	Chitalwana	Luni	Luni	MINOR	24.778130	71.430410	5.70	2,250.00	0.23	0.23	-	328.00	-	-	75.37	75.37

S. No.	Project Name	District	Block	Basin	Sub-basin	Class	Latitude (DD)	Longitude (DD)	Ht. above Lowest Foundation (m)	Length of Dam (m)	Gross Storage Capacity (Mm^3)	Live Storage Capacity (Mm^3)	Reservoir Area at FRL (km^2)	Design Spilway Capacity (cusecs)	Length of Canal System (km)	Command Area (ha)		
																GCA	CCA	ICA
1	2	3	4	5	6	7	9	10	11	12	13	14	15	16	17	18	19	20
2117	Suthri II X bund	JALORE	Chitalwana	Luni	Luni	Minor	24.782505	71.429163				0.23					75.37	
2091	Suthri X bund	JALORE	Chitalwana	Luni	Luni	MINOR	24.782898	71.429356				4.65					593.90	
2092	Tampi X bund	JALORE	Chitalwana	Luni	Luni	MINOR	24.863791	71.523807	6.40	131.04	0.85	0.85	7.94				192.71	429.80
2095	Tetrol X bund	JALORE	Chitalwana	Luni	Luni	MINOR	24.989372	71.679094			0.05	0.05					32.40	32.40
2101	Varnwa I X bund	JALORE	Chitalwana	Luni	Luni	MINOR	24.755980	71.471561		2,030.00	2.63	2.53	-	464.95	-	-	159.85	159.85
2102	Varnwa II X bund	JALORE	Chitalwana	Luni	Luni	MINOR	24.750149	71.452243	3.40	1,914.00	1.30	1.30	-	49.91	-	-	183.00	183.00
1989	Dantwara Bund	JALORE	Raniwara	Luni	Luni	MINOR	24.871187	72.088369	6.20	1,077.00	0.54	0.45	-	110.05	1.32 km	138.00	138.00	84.00
2034	Llyadara X bund	JALORE	Sanchore	Luni	Luni	MINOR	24.918717	71.921900				0.49					42.00	
2049	Pamana X bund	JALORE	Sanchore	Luni	Luni	MINOR	24.950000	72.000000	27.00 ft	1400 ft	1.34	1.34	-	186.78	-	-	40.00	48.58
2202	Bailwa Anicut II	JODHPUR	Balesar	Luni	Luni	MINOR	26.444486	72.577513				0.10					14.16	
2203	Bailwa Ranaji Bandh I	JODHPUR	Balesar	Luni	Luni	MINOR	26.485611	72.538722				0.08					12.01	
2217	Bastua Bandh	JODHPUR	Balesar	Luni	Luni	MINOR	26.540461	72.587085				0.10					8.62	
2218	Bastua Khadeen I	JODHPUR	Balesar	Luni	Luni	MINOR	26.555114	72.589414				0.18					21.45	
2219	Bastua Mataji Anicut	JODHPUR	Balesar	Luni	Luni	MINOR	26.535092	72.565742				0.26					37.32	
2380	Bawariyo ka Sar anicut	JODHPUR	Balesar	Luni	Luni	Minor	26.388556	72.733466				0.14					20.00	
2220	Bawri Kala Khadeen	JODHPUR	Balesar	Luni	Luni	MINOR	26.513543	72.345845				0.04					40.00	
2221	Bawri Purohitan Khadeen	JODHPUR	Balesar	Luni	Luni	MINOR	26.516603	72.336212				0.08					75.00	
2381	Bhalurajawat Anicut	JODHPUR	Balesar	Luni	Luni	Minor	26.580065	72.468233				0.11					16.00	
2251	Deriya Bandh I	JODHPUR	Balesar	Luni	Luni	MINOR	26.582809	72.569778				0.09					12.24	
2252	Deriya Bandh II	JODHPUR	Balesar	Luni	Luni	MINOR	26.591114	72.570155				0.15					10.89	
2421	Dhadaniya Bundh	JODHPUR	Balesar	Luni	Luni	Minor	26.287262	72.523266				0.06					80.00	
2254	Dhadhaniya Bandh	JODHPUR	Balesar	Luni	Luni	MINOR	26.340540	72.576612				0.35					82.00	
2391	Dukiya Khadeen	JODHPUR	Balesar	Luni	Luni	Minor	26.324308	72.560263				0.06					33.00	
2265	Gopalsar Bandh	JODHPUR	Balesar	Luni	Luni	MINOR	26.495129	72.590894				0.04					9.50	
2288	Ketu Hema Anicut	JODHPUR	Balesar	Luni	Luni	MINOR	26.488790	72.470021				0.11					15.00	
2289	Ketu Kala Bandh	JODHPUR	Balesar	Luni	Luni	MINOR	26.518378	72.482448				0.09					20.00	
2290	Ketukala Dhokalwas Bera	JODHPUR	Balesar	Luni	Luni	MINOR	26.503827	72.483394				0.09					25.00	
2340	Purohito Wala Bandh	JODHPUR	Balesar	Luni	Luni	MINOR	26.327373	72.695209				0.18					57.00	
2417	Thakarwala Bundh	JODHPUR	Balesar	Luni	Luni	Minor	26.643752	72.628883				0.23					20.00	
2419	Vastua Mataji Anicut	JODHPUR	Balesar	Luni	Luni	Minor	26.505793	72.573809				0.26					37.33	
2420	Vastuas Sundo Ka Bas	JODHPUR	Balesar	Luni	Luni	Minor	26.559993	72.607560				0.08					15.00	
2229	Bhari nagar Bandh	JODHPUR	Bawari	Luni	Luni	MINOR	26.800133	73.273572				0.17					24.00	
2423	Birai Bundh	JODHPUR	Bawari	Luni	Luni	Minor	26.595429	73.293681	21.00	2,430.00	2.80	2.78	1,174.00	566.23		1,478.41	531.00	
2386	Danwara Bundh	JODHPUR	Bawari	Luni	Luni	Minor	26.720789	73.062858				0.10					84.00	
2387	Dawarawala Khadeen	JODHPUR	Bawari	Luni	Luni	Minor	26.724595	73.091184				0.17					20.37	
2270	Harthani Bandh	JODHPUR	Bawari	Luni	Luni	MINOR	26.700799	73.192845				0.12					118.00	
2304	Lavera Kala Bandh	JODHPUR	Bawari	Luni	Luni	MINOR	26.724670	73.247607				0.84					142.00	
2305	Lavera Kala Khadeen	JODHPUR	Bawari	Luni	Luni	MINOR	26.678466	73.268569				0.84					142.00	
2317	Nadiyan Kala	JODHPUR	Bawari	Luni	Luni	MINOR	26.763077	73.190411				0.17					121.00	
2368	Umed Nagar I	JODHPUR	Bawari	Luni	Luni	MINOR	26.558094	73.015591				0.10					62.00	
2195	Artia Kalan Anicut	JODHPUR	Bhopalgarh	Luni	Luni	MINOR	26.554271	73.399202				0.25					35.00	
2196	Artia Khurd	JODHPUR	Bhopalgarh	Luni	Luni	MINOR	26.554355	73.435965				0.50					72.00	
2197	Artiawala Bandh	JODHPUR	Bhopalgarh	Luni	Luni	MINOR	26.548036	73.413145				0.45					64.00	
2205	Bairna Bandh	JODHPUR	Bhopalgarh	Luni	Luni	MINOR	26.717833	73.587665				0.09					13.13	
2235	Bhilova ka Tambria Anicut	JODHPUR	Bhopalgarh	Luni	Luni	MINOR	26.603868	73.407821				0.06					8.27	
2245	Burchha Anicut	JODHPUR	Bhopalgarh	Luni	Luni	MINOR	26.586956	73.512522				0.07					10.00	
2248	Chhaplasar Bandh	JODHPUR	Bhopalgarh	Luni	Luni	MINOR	26.641179	73.617795				0.06					26.00	
2389	Dhoru Bundh	JODHPUR	Bhopalgarh	Luni	Luni	Minor	26.591540	73.464839	4.57	1,334.00	0.14	0.14	0.03	561.00	Small W.Course	50.60	20.00	20.24
2372	Hiradesar bundh - II	JODHPUR	Bhopalgarh	Luni	Luni	Minor	26.614382	73.386623				0.13					180.00	
2271	Hiradesar bundh I	JODHPUR	Bhopalgarh	Luni	Luni	MINOR	26.632307	73.389010				0.13					60.00	
2399	Kudi Fitter	JODHPUR	Bhopalgarh	Luni	Luni	Minor	26.546775	73.487650				0.04					6.00	
2299	Kuri Bandh	JODHPUR	Bhopalgarh	Luni	Luni	MINOR	26.570267	73.464576				1.12					160.00	
2411	Rajlani anicut	JODHPUR	Bhopalgarh	Luni	Luni	Minor	26.689022	73.630022				0.14					7.00	
2341	Rajlani Bandh	JODHPUR	Bhopalgarh	Luni	Luni	MINOR	26.689554	73.632039				0.10					14.50	
2359	Sophara Anicut	JODHPUR	Bhopalgarh	Luni	Luni	MINOR	26.613382	73.420207				0.15					22.00	
2363	Tambria Anicut-II	JODHPUR	Bhopalgarh	Luni	Luni	MINOR	26.593512	73.352014				0.07					10.00	
2364	Tambria Bandh-I	JODHPUR	Bhopalgarh	Luni	Luni	MINOR	26.587506	73.357845				0.46					66.00	
2369	Ustra Anicut (Mandli Gaon)	JODHPUR	Bhopalgarh	Luni	Luni	MINOR	26.665536	73.392171				0.09					18.00	
2208	Bala Khadeen	JODHPUR	Bilara	Luni	Luni	MINOR	26.189491	73.526714				0.78					14.12	
2215	Barnaber Anicut	JODHPUR	Bilara	Luni	Luni	MINOR	26.425229	73.808897				0.26					41.70	
2225	Bhagasani Anicut	JODHPUR	Bilara	Luni	Luni	MINOR	26.301577	73.729662				0.14					20.00	
2231	Bhavi Bara Talab Anicut	JODHPUR	Bilara	Luni	Luni	MINOR	26.227881	73.611601				0.11					15.00	
2232	Bhavi Sand Pali	JODHPUR	Bilara	Luni	Luni	MINOR	26.215990	73.618842				0.47					70.00	
2236	Bhiruji ka Baga/ Murkavri Anicut	JODHPUR	Bilara	Luni	Luni	MINOR	26.331998	73.804848				0.18					23.43	
2243	Birawas Anicut-I	JODHPUR	Bilara	Luni	Luni	MINOR	26.248629	73.683064				0.29					42.00	
2267	Gurjaron Ki Dhani Bandh	JODHPUR	Bilara	Luni	Luni	MINOR	26.313984	73.763507				0.06					8.00	

S. No.	Project Name	District	Block	Basin	Sub-basin	Class	Latitude (DD)	Longitude (DD)	Ht. above Lowest Foundation (m)	Length of Dam (m)	Gross Storage Capacity (Mm^3)	Live Storage Capacity (Mm^3)	Reservoir Area at FRL (km^2)	Design Spilway Capacity (cusecs)	Length of Canal System (km)	Command Area (ha)		
																GCA	CCA	ICA
1	2	3	4	5	6	7	9	10	11	12	13	14	15	16	17	18	19	20
2268	Hariyada Anicut	JODHPUR	Bilara	Luni	Luni	MINOR	26.160566	73.449495				1.55					21.66	
2273	Hungaon Khadeen	JODHPUR	Bilara	Luni	Luni	MINOR	26.143685	73.419782				0.14					20.00	
2395	Jurli Anicut	JODHPUR	Bilara	Luni	Luni	Minor	26.213001	73.649750				0.01					17.52	
2302	Lamba Pick up Wear	JODHPUR	Bilara	Luni	Luni	MINOR	26.209742	73.555841				1.48					211.00	
2303	Lambayatsar	JODHPUR	Bilara	Luni	Luni	MINOR	26.205530	73.563357				0.51					98.00	
2373	Malkosani	JODHPUR	Bilara	Luni	Luni	Minor	26.160610	73.609519				0.04					42.51	
2316	Murkasani Anicut	JODHPUR	Bilara	Luni	Luni	MINOR	26.331153	73.803602				0.13					18.00	
2375	Olvi Anicut	JODHPUR	Bilara	Luni	Luni	Minor	26.198786	73.428303				0.07					11.00	
2329	Olvi Bandh	JODHPUR	Bilara	Luni	Luni	MINOR	26.196136	73.440821				0.25					35.63	
2342	Ramasani Anicut	JODHPUR	Bilara	Luni	Luni	MINOR	26.180325	73.402219				0.18					25.00	
2343	Ramasani Anicut	JODHPUR	Bilara	Luni	Luni	MINOR	26.182532	73.401355				0.14					20.00	
2344	Ramasani Dam-I	JODHPUR	Bilara	Luni	Luni	MINOR	26.180494	73.390970				0.20					29.00	
2412	Ransi Gaon Anicut	JODHPUR	Bilara	Luni	Luni	Minor	26.367573	73.742567				0.06					10.00	
2413	Ransi Gaon Bundh	JODHPUR	Bilara	Luni	Luni	Minor	26.356430	73.757056				0.09					10.49	
2240	Biram Khadeen II	JODHPUR	Luni	Luni	Luni	MINOR	26.154108	73.229098				0.19					28.00	
2241	Birami Khadeen	JODHPUR	Luni	Luni	Luni	MINOR	26.150575	73.229460				0.61					74.00	
2383	Bujhawar Bundh	JODHPUR	Luni	Luni	Luni	Minor	26.224524	72.901898				0.22					19.00	
2390	Doli Anicut	JODHPUR	Luni	Luni	Luni	Minor	26.177764	72.892325				0.09					14.03	
2392	Gujarawas Anicut	JODHPUR	Luni	Luni	Luni	Minor	26.132702	73.202322				0.06					17.56	
2394	Jatiyashani Bhakari Anicut	JODHPUR	Luni	Luni	Luni	Minor	26.107850	72.831936				0.17					45.00	
2294	Khejrli Anicut-I	JODHPUR	Luni	Luni	Luni	MINOR	26.151083	73.143612				0.08					12.00	
2295	Khejrli Anicut-II	JODHPUR	Luni	Luni	Luni	MINOR	26.132324	73.178056				0.06					8.00	
2314	Meghwalowala Jhanwar	JODHPUR	Luni	Luni	Luni	MINOR	26.202066	72.849646				0.13					18.00	
2407	Modi Suthara Anicut	JODHPUR	Luni	Luni	Luni	Minor	26.084700	73.193729				0.04					16.00	
2315	Mori Josiyan	JODHPUR	Luni	Luni	Luni	MINOR	26.099108	73.237733				0.25					76.00	
2321	Narnari Anicut I	JODHPUR	Luni	Luni	Luni	MINOR	26.154468	72.893449				0.18					27.00	
2322	Narnari Anicut II	JODHPUR	Luni	Luni	Luni	MINOR	26.148867	72.906060				0.18					16.20	
2327	Nimbla Bandh	JODHPUR	Luni	Luni	Luni	MINOR	26.049221	73.098571				0.62					99.00	
2335	Patliyawas Anicut	JODHPUR	Luni	Luni	Luni	MINOR	26.111374	73.065121				0.07					9.91	
2352	Sajara Nai Basti Bandh	JODHPUR	Luni	Luni	Luni	MINOR	26.114205	73.237022				0.22					43.00	
2210	Banad Anicut	JODHPUR	Mandor	Luni	Luni	MINOR	26.333792	73.148829				0.28					40.00	
2216	Basani Beda Anicut	JODHPUR	Mandor	Luni	Luni	MINOR	26.241971	73.089388				0.40					20.00	
2223	Beru Bandh	JODHPUR	Mandor	Luni	Luni	MINOR	26.381945	72.878394				0.21					44.00	
2253	Desuria Bandh	JODHPUR	Mandor	Luni	Luni	MINOR	26.386804	73.078153				0.08					45.33	
2257	Gadeeya Khandin	JODHPUR	Mandor	Luni	Luni	MINOR	26.398400	72.873748				0.07					25.00	
2262	Ghantiyala Bandh	JODHPUR	Mandor	Luni	Luni	MINOR	26.392706	72.755767				0.80					141.00	
2263	Ghatiwala Anicut	JODHPUR	Mandor	Luni	Luni	MINOR	26.388008	72.773295				0.15					21.00	
2393	Indro Ki Dhani	JODHPUR	Mandor	Luni	Luni	Minor	26.439113	72.902512				0.14					87.00	
2274	Jajiwal Bhatia Khadeen	JODHPUR	Mandor	Luni	Luni	MINOR	26.416487	73.162290				0.20					30.00	
2275	Jajiwal Kalan Khadeen	JODHPUR	Mandor	Luni	Luni	MINOR	26.368067	73.164186				0.20					20.00	
2282	Kali Bhakhari	JODHPUR	Mandor	Luni	Luni	MINOR	26.391610	72.971765				0.10					40.00	
2287	Keru Bandh	JODHPUR	Mandor	Luni	Luni	MINOR	26.348984	72.872496				0.33					41.02	
2307	Lordia Pandit Ji Khadeen	JODHPUR	Mandor	Luni	Luni	MINOR	26.423981	73.134492				1.25					179.00	
2374	Naiyon wala Khadeen Shekhasar-II	JODHPUR	Mandor	Luni	Luni	Minor	26.266565	72.798067				0.55					80.00	
2318	Nandra Kalan	JODHPUR	Mandor	Luni	Luni	MINOR	26.286435	73.123008				0.36					26.31	
2319	Nandra Khurd Anicut	JODHPUR	Mandor	Luni	Luni	MINOR	26.293171	73.137553				0.51					37.30	
2320	Nari Wala Khadeen	JODHPUR	Mandor	Luni	Luni	MINOR	26.246142	72.828439				0.05					82.00	
2338	Popawas Bandh I	JODHPUR	Mandor	Luni	Luni	MINOR	26.359239	72.794068				0.13					54.00	
2339	Popawas Bandh II	JODHPUR	Mandor	Luni	Luni	MINOR	26.357472	72.786670				0.25					41.02	
2349	Rohika Kalan Anicut	JODHPUR	Mandor	Luni	Luni	MINOR	26.238826	72.863153				0.18					25.00	
2360	Surpura bund	JODHPUR	Mandor	Luni	Luni	MINOR	26.356111	73.067778				2.16					1,137.00	
2367	Uccharia Anicut	JODHPUR	Mandor	Luni	Luni	MINOR	26.262007	73.128109				0.47					16.00	
2198	Bada Kotecha Bandh	JODHPUR	Osian	Luni	Luni	MINOR	26.516325	72.827315				0.10					103.00	
2206	Baithwasiya Khadeen	JODHPUR	Osian	Luni	Luni	MINOR	26.797531	72.949479				0.19					75.00	
2209	Balkha Anicut II	JODHPUR	Osian	Luni	Luni	MINOR	26.483333	72.900000				0.05					22.00	
2211	Bankha Anicut I	JODHPUR	Osian	Luni	Luni	MINOR	26.480552	72.897080				0.05					92.00	
2224	Bethwasiya Bandh	JODHPUR	Osian	Luni	Luni	MINOR	26.799358	72.965726				0.19					100.00	
2234	Bhikam Kor Bhinaria	JODHPUR	Osian	Luni	Luni	MINOR	26.797491	72.796005				0.57					82.00	
2238	Bigmi Khadeen	JODHPUR	Osian	Luni	Luni	MINOR	26.675432	72.943392				0.13					60.00	
2239	Bijwardiya Bandh	JODHPUR	Osian	Luni	Luni	MINOR	26.557083	72.794864				0.20					70.00	
2256	Dudhariya Bandh	JODHPUR	Osian	Luni	Luni	MINOR	26.726256	72.973794				0.07					55.00	
2259	Gagari Khadeen	JODHPUR	Osian	Luni	Luni	MINOR	26.568502	72.752435				0.57					95.00	
2279	Jelu Anicut	JODHPUR	Osian	Luni	Luni	MINOR	26.529108	72.770440				0.09					45.54	
2280	Jelu Bandh	JODHPUR	Osian	Luni	Luni	MINOR	26.535634	72.763239				0.06					54.55	
2291	Khabra Khadeen	JODHPUR	Osian	Luni	Luni	MINOR	26.724190	72.777735				0.04					45.00	
2398	Kharda Mewasa Khadeen	JODHPUR	Osian	Luni	Luni	Minor	26.658830	73.028875				0.25					90.00	
2312	Maluga Bandh	JODHPUR	Osian	Luni	Luni	MINOR	26.473135	72.808784				0.03					75.50	

S. No.	Project Name	District	Block	Basin	Sub-basin	Class	Latitude (DD)	Longitude (DD)	Ht. above Lowest Foundation (m)	Length of Dam (m)	Gross Storage Capacity (Mm^3)	Live Storage Capacity (Mm^3)	Reservoir Area at FRL (km^2)	Design Spilway Capacity (cusecs)	Length of Canal System (km)	Command Area (ha)		
																GCA	CCA	ICA
1	2	3	4	5	6	7	9	10	11	12	13	14	15	16	17	18	19	20
2323	Navora Bera	JODHPUR	Osian	Luni	Luni	MINOR	26.679145	72.997244				0.06					8.51	
2325	Nevera Bandh	JODHPUR	Osian	Luni	Luni	MINOR	26.681841	72.991887				0.04					130.00	
2326	Nevra Khadeen	JODHPUR	Osian	Luni	Luni	MINOR	26.687736	72.997669				0.11					45.00	
2331	Pandit Ji Ki Dhani	JODHPUR	Osian	Luni	Luni	MINOR	26.823874	72.952210				0.07					20.00	
2353	Sakori Bandh	JODHPUR	Osian	Luni	Luni	MINOR	26.427778	72.783333				0.68					76.00	
2355	Sindhiyon Ki Dhani Anicut	JODHPUR	Osian	Luni	Luni	MINOR	26.489207	73.026443				0.10					45.40	
2356	Sindhiyon Ki Dhani Anicut-I	JODHPUR	Osian	Luni	Luni	MINOR	26.482002	73.036332				0.59					17.00	
2365	Thob Bandh	JODHPUR	Osian	Luni	Luni	MINOR	26.755910	73.020336				0.39					79.00	
2228	Bhandu Charana Anicut	JODHPUR	Shergarh	Luni	Luni	MINOR	26.353471	72.447900				0.60					85.00	
2382	Bhandu Charna AnicutII	JODHPUR	Shergarh	Luni	Luni	Minor	26.353371	72.443448				0.12					17.00	
2246	Burkiya Bandh	JODHPUR	Shergarh	Luni	Luni	MINOR	26.719230	72.181617				1.18					168.00	
2366	Tibana Anicut	JODHPUR	Shergarh	Luni	Luni	MINOR	26.361789	72.366008				0.08					11.44	
2586	Harsolav I	NAGAUR	Merta	Luni	Luni	Minor	26.727196	73.706759	2.50	1,010.00	0.13	0.50	-	1,135.00	-	36.15	16.99	36.15
2544	Matadungri Bund	NAGAUR	Merta	Luni	Luni	MINOR	26.503932	73.948554				0.60					21.45	
2511	Chittani Bund	NAGAUR	Mundwa	Luni	Luni	MINOR	26.840285	73.725391				0.33					59.72	
2492	Banwal Bund-I	NAGAUR	Parbatsar	Luni	Luni	MINOR	26.617435	74.656470				0.18					39.98	
2501	Bherunda bund	NAGAUR	Riyan	Luni	Luni	MINOR	26.521796	74.366671	10.86	670.56	2.94	2.59	1.01	30.74	10.80	549.17	540.67	352.08
2504	Bijathal Bund	NAGAUR	Riyan	Luni	Luni	MINOR	26.472999	74.254478				0.29					25.57	
2538	Ladpura Bund	NAGAUR	Riyan	Luni	Luni	MINOR	26.500000	74.391667				0.16					66.00	
2549	Narsing Basni bund	NAGAUR	Riyan	Luni	Luni	MINOR	26.531426	74.384197	5.55	268.22	0.43	0.38		1,271.00	-	-	180.65	144.00
2556	Peepliya bund-I	NAGAUR	Riyan	Luni	Luni	MINOR	26.455313	74.338247				0.11					16.16	
2557	Peepliya bund-II	NAGAUR	Riyan	Luni	Luni	MINOR	26.455955	74.339821				0.21					18.56	
2562	Rata Dundha Bund	NAGAUR	Riyan	Luni	Luni	MINOR	26.574447	74.485624	NA	1,030.00	109.82	0.26	NA	8,522.00	6.12	188.00	66.80	100.00
2565	Satham Bund	NAGAUR	Riyan	Luni	Luni	MINOR	26.528631	74.452903				0.69					36.00	
2597	Balada	PALI	Jaitaran	Luni	Luni	MINOR	26.288919	74.073478	5.50	2,097.00	0.35	0.37	NA	112.20	0.90	95.14	87.00	57.00
2629	Kali Kankar	PALI	Jaitaran	Luni	Luni	MINOR	26.361328	73.992380	NA	1,083.00	1.61	1.60	NA	5,495.00	6.45	447.19	379.20	230.00
2650	Mira Kudki Bandh	PALI	Jaitaran	Luni	Luni	MINOR	26.364975	74.184187	6.70	330.00	0.89	0.88	NA	275.80	1.05	397.42	256.00	119.00
2659	Phutia Bhumbiliya	PALI	Jaitaran	Luni	Luni	MINOR	26.384758	74.084638	2.90	2,240.00	0.28	0.28	NA	61.60	1.22	58.00	49.00	39.00
2678	Shiv Sagar Bhumblia	PALI	Jaitaran	Luni	Luni	MINOR	26.398372	74.135297	4.50	2,340.00	0.44	0.44	NA	97.70	1.37	80.94	118.00	32.35
2594	Babra	PALI	Raipur	Luni	Luni	MINOR	26.224012	74.273870	11.00	350.00	3.77	2.36	NA	816.50	8.49	598.48	538.00	482.87
2602	Bar Bandh	PALI	Raipur	Luni	Luni	MINOR	26.079449	74.105145	6.40	167.60	1.66	1.66	NA	178.42	0.55	971.28	264.80	267.10
2693	Birantiya	PALI	Raipur	Luni	Luni	Minor	26.116047	74.149773	11.61	200.00	0.42	0.78	NA	254.67	4.11	69.60	75.20	46.54
2617	Girinanda	PALI	Raipur	Luni	Luni	MINOR	26.181600	74.167694	10.67	350.50	5.66	5.59	NA	445.87	11.74	1,839.31	1,433.00	860.00
2621	Gulab Sagar Bandh	PALI	Raipur	Luni	Luni	MINOR	26.167946	74.220523	7.92	396.20	0.45	0.45	NA	90.09	9.64	262.00	105.00	150.00
2633	Kamos Tank	PALI	Raipur	Luni	Luni	MINOR	26.282241	74.254315				0.30					26.00	
2654	Nimbli Bandh	PALI	Rohat	Luni	Luni	MINOR	26.004272	73.077022	3.40	2,580.00	0.69	0.70	-	223.29	-	263.00	200.00	200.00
2685	Tutia Bandh	PALI	Rohat	Luni	Luni	MINOR	26.052562	73.239937	1.83	1,861.00	0.96	0.96	NA	2,450.00	-	73.00	62.00	53.00
2786	Khatian Tank	RAJSAMAND	Bhim	Luni	Luni	MINOR	25.983333	74.325000				0.16					26.00	
	Sub Basin Total										**710.85**	**222.34**				**19,688.91**	**39,981.63**	**24,570.99**
1960	Akoda X bund	JALORE	Ahore	Luni	Mithari	MINOR	25.446909	72.892593	4.79	1,950.00	0.10	0.57	-	4.91	-	-	183.00	183.00
1972	Bawarda Bund	JALORE	Ahore	Luni	Mithari	MINOR	25.502595	72.974098	23.17 ft.	4260 FT.	2.24	2.02	-	349.22	3.00	-	282.88	234.61
1977	Bhawarani Khadeen	JALORE	Ahore	Luni	Mithari	MINOR	25.568300	72.661946	2.91 M	969 M	0.10	0.10	-	33.96	-	-	15.00	18.00
2014	Kaniwara Bund	JALORE	Ahore	Luni	Mithari	MINOR	25.519752	72.968466	5.55 M	2262 M	0.84	0.80	-	140.28	1.98	240.00	223.00	223.00
2018	Karwara bund	JALORE	Ahore	Luni	Mithari	MINOR	25.453910	72.983728	6.00	446.00	0.17	0.15	-	37.80		55.00	28.00	25.00 bed
2045	Nosra Canal	JALORE	Ahore	Luni	Mithari	MINOR	25.535032	72.762168				7.50					1,880.00	
2116	Shankwali khadeen	JALORE	Ahore	Luni	Mithari	Minor	25.491100	72.873865	2.65 M	1200 M	0.30	0.30	-	78.95	-	-	25.20	80.00
2096	Thumbh Khadeen	JALORE	Ahore	Luni	Mithari	MINOR	25.403078	72.954299	-	-	0.11	0.11					15.20	
2607	Dantiwara	PALI	Bali	Luni	Mithari	MINOR	25.235671	73.333220	10.00	542.50	2.77	2.63	NA	143.20	6,270.00	797.00	794.00	494.00
2625	Jadari Diversion Dam	PALI	Bali	Luni	Mithari	MINOR	25.227236	73.237266	6.00	2,746.25	0.85	0.71		244.97	10.00Ch		100.82	
2630	Kamoti Bandh	PALI	Bali	Luni	Mithari	MINOR	25.168664	73.292481				0.21					38.00	
2637	Khiwandi-Bankli Bund	PALI	Bali	Luni	Mithari	MINOR	25.229386	73.213313				7.40					1,341.30	
2640	Kot	PALI	Bali	Luni	Mithari	MINOR	25.182337	73.338898	8.10	3,930.00	2.86	2.74	NA	223.54	9,090.00	283.00	527.00	469.00
2641	Latara	PALI	Bali	Luni	Mithari	MINOR	25.141276	73.397451	21.00	76.00	1.41	1.36	NA	156.75	2,490.00	422.21	405.00	249.00
2643	Madra ki Nal Bandh	PALI	Bali	Luni	Mithari	MINOR	25.117413	73.372530	6.00	360.00	0.47	0.47	NA	49.66	780.00	215.20	165.00	66.00
2651	Mithri	PALI	Bali	Luni	Mithari	MINOR	25.065552	73.316654	15.70	1,545.00	8.71	8.32	NA	433.00	4,570.00	1,996.00	1,953.00	1,129.00
2656	Peerwa Bandh	PALI	Bali	Luni	Mithari	MINOR	25.152409	73.212953				0.87					64.73	
2658	Phutelao Bandh	PALI	Bali	Luni	Mithari	MINOR	25.103827	73.341960	4.00	216.00	0.15	0.15	NA	16.98	100.00	35.60	27.00	18.80
2660	Phutiya	PALI	Bali	Luni	Mithari	MINOR	25.206710	73.213103	5.50	4,903.00	1.54	1.37	NA	138.75	3,480.00	380.00	353.00	233.00
2661	Pipla	PALI	Bali	Luni	Mithari	MINOR	25.110910	73.314213	7.10	159.00	0.36	0.32	NA	38.20	240m	130.00	79.00	48.00
2675	Saravja Bandh	PALI	Bali	Luni	Mithari	MINOR	25.197853	73.204652	7.00	58.00	0.25	0.23	NA	40.83	450.00	61.20	41.00	34.80
2677	Sewari	PALI	Bali	Luni	Mithari	MINOR	25.067988	73.364387	8.60	111.00	0.20	0.18	NA	24.84	450.00	44.00	44.00	26.00
2683	Sonwa Bandh	PALI	Bali	Luni	Mithari	MINOR	25.099323	73.327732	11.50	760.00	0.93	0.93	NA	75.56	1,200.00	196.80	196.00	142.40
2596	Bajarwala Bandh	PALI	Desuri	Luni	Mithari	MINOR	25.153817	73.434206	11.15	160.00	0.36	0.36	NA	42.45	360.00	61.20	53.00	48.80
2612	Dujana Bund	PALI	Sumerpur	Luni	Mithari	MINOR	25.274075	73.129304	9.25	3,283.00	0.70	0.67		92.75	52Ch		112.00	
2680	Sindroo Dam	PALI	Sumerpur	Luni	Mithari	MINOR	25.261025	73.158517	27.00	1,836.42	8.85	8.10		266.86	3.80 Ch		1,157.59	
2684	Takhatgarh Bundh	PALI	Sumerpur	Luni	Mithari	MINOR	25.341282	73.023109	8.00	3,566.16	1.97	1.91		237.89	19Ch		272.99	
	Sub Basin Total										**36.22**	**50.46**				**4,917.21**	**10,376.70**	**3,697.41**

S. No.	Project Name	District	Block	Basin	Sub-basin	Class	Latitude (DD)	Longitude (DD)	Ht. above Lowest Foundation (m)	Length of Dam (m)	Gross Storage Capacity (Mm^3)	Live Storage Capacity (Mm^3)	Reservoir Area at FRL (km^2)	Design Spilway Capacity (cusecs)	Length of Canal System (km)	Command Area (ha)		
																GCA	CCA	ICA
1	2	3	4	5	6	7	9	10	11	12	13	14	15	16	17	18	19	20
2037	Malwara Bund	JALORE	Jaswantpura	Luni	Sagi	MINOR	24.782566	72.328045	3.81	840.00	0.15	0.12	-	34.53		30.35	20.23	14.16
2058	Rajikawas bund	JALORE	Jaswantpura	Luni	Sagi	MINOR	24.867727	72.399598	6.88	585.00	0.35	0.32	-	149.56	690.00	159.06	57.31	45.30
2059	Rajpura bund I	JALORE	Jaswantpura	Luni	Sagi	MINOR	24.851350	72.388249	11.10	300.00	0.46	0.42	-	72.65		89.45	80.97	60.73
2060	Rajpura bund II	JALORE	Jaswantpura	Luni	Sagi	MINOR	24.852838	72.329844	7.56	301.00	0.31	0.28	-	59.60	1,260.00		67.73	55.34
1973	Beretha bund I	JALORE	Raniwara	Luni	Sagi	MINOR	24.904300	72.226283	9.10	1,110.00	0.56	0.49	-	51.62		330.00	288.00	200.00
1974	Beretha bund II	JALORE	Raniwara	Luni	Sagi	MINOR	24.918753	72.229075	5.63	496.00	0.14	0.14	-	64.85		46.96	46.96	41.00
1982	Chatwara bund	JALORE	Raniwara	Luni	Sagi	MINOR	24.907179	72.128664	6.15	540.00	0.18	0.14	-	67.92			40.50	40.50
1995	Dolpura	JALORE	Raniwara	Luni	Sagi	MINOR	24.805511	72.276095	3.36	1,155.00	1.03	1.03	0.66	7,838.00	2.70	237.50	213.00	160.00
2017	Karda bund	JALORE	Raniwara	Luni	Sagi	MINOR	24.902943	72.143291	6.41	870.00	0.17	0.16	-	56.60		80.00	33.00	55.00
2022	Kheda Sumergarh bund	JALORE	Raniwara	Luni	Sagi	MINOR	24.857717	72.188471	6.66	2,100.00	1.14	1.00	0.65	119.22			384.00	230.40
2026	Kortia bund	JALORE	Raniwara	Luni	Sagi	MINOR	24.958106	72.060754				0.19					27.00	
2029	Lakawas Bund II	JALORE	Raniwara	Luni	Sagi	MINOR	24.893279	72.170201	6.35	605.00	0.15	0.14	-	53.51		53.42	40.50	40.50
2030	Lakhawas Bund	JALORE	Raniwara	Luni	Sagi	MINOR	24.905262	72.169863			0.34	0.34					40.00	
2031	Lakhawas Kn. II	JALORE	Raniwara	Luni	Sagi	MINOR	24.885399	72.170520	6.35	605.00	0.15	0.14	-	53.52		53.40	53.00	40.00
2032	lalpura bund	JALORE	Raniwara	Luni	Sagi	MINOR	24.910058	72.150928	6.22	343.00	0.14	0.14	-	151.25		57.00	51.00	41.00
2070	Roopsi bund	JALORE	Raniwara	Luni	Sagi	MINOR	24.937255	72.194264	6.30	720.00	0.13	0.13	-	95.98		41.00	37.00	37.00
2081	Silwason bund	JALORE	Raniwara	Luni	Sagi	MINOR	24.875518	72.238877	26.50 ft.	900 ft.	0.33	0.31	-	81.25	3000 ft.	52.60	35.20	25.20
2094	Tavidar bund	JALORE	Raniwara	Luni	Sagi	MINOR	24.868175	72.195354	3.50	930.00	0.61	0.52	-	1.62	1.30	120.00	110.00	74.00
2100	Vandhar bund	JALORE	Raniwara	Luni	Sagi	MINOR	24.800296	72.194139	7.36	1,255.00	4.05	3.17	1.56	319.79	4.60	573.00	504.00	453.00
	Sub Basin Total										**10.38**	**9.19**				**1,923.74**	**2,129.40**	**1,613.13**
2036	Malgarh bund	JALORE	Ahore	Luni	Sukri	MINOR	25.598995	72.962819	3.71 M	881 M	0.47	0.42	-	87.96	144.00	125.00	125.00	40.00
2692	Bamniiya	PALI	Bali	Luni	Sukri	Minor	25.298933	73.331491	6.27	2,040.75	0.59	0.59	NA	68.81	1,770.00	186.00	171.00	114.00
2686	Ungati Bandh	PALI	Bali	Luni	Sukri	MINOR	25.277661	73.358560	3.35	446.00	0.90	0.90	NA	89.03	157.00	219.20	173.00	121.60
2696	Choodawala	PALI	Desuri	Luni	Sukri	Minor	25.245504	73.457530	10.01	1,023.00	1.57	1.52	NA	113.56	3,450.00	263.20	242.80	218.80
2616	Ghoradhara	PALI	Desuri	Luni	Sukri	MINOR	25.306208	73.567210				2.80					282.00	
2628	Juna malari	PALI	Desuri	Luni	Sukri	MINOR	25.132753	73.468900	10.50	1,915.00	1.75	1.69	NA	146.08	3,750.00	450.00	323.00	240.00
2631	kana	PALI	Desuri	Luni	Sukri	MINOR	25.261025	73.515338	12.63	1,143.00	3.05	3.10	NA	697.00	10,710.00	812.49	1,031.00	507.00
2634	Kesuli	PALI	Desuri	Luni	Sukri	MINOR	25.376764	73.550524	10.70	137.10	2.42	2.72	NA	258.50	2,580.00	587.00	312.00	308.00
2636	Khetalaji Bandh	PALI	Desuri	Luni	Sukri	MINOR	25.287564	73.504419	7.38	45.00	0.41	0.41	NA	47.60	540.00	69.80	69.00	55.45
2648	Mandigarh Bandh	PALI	Desuri	Luni	Sukri	MINOR	25.181645	73.517003	9.76	110.00	0.26	0.45	NA	109.60	540.00	110.00	44.00	41.20
2653	Muthana	PALI	Desuri	Luni	Sukri	MINOR	25.245921	73.457228	12.00	1,079.00	2.72	3.30	NA	199.20	8,700.00	608.38	630.00	367.00
2666	Rajpura	PALI	Desuri	Luni	Sukri	MINOR	25.163697	73.496460	12.50	558.00	2.54	2.24	NA	166.40	4,290.00	720.00	956.00	350.00
2671	Sadri	PALI	Desuri	Luni	Sukri	MINOR	25.198254	73.469257	28.44	349.50	5.80	5.80	NA	477.33	19,259.00	1,382.28	1,339.00	930.00
2676	Seli Ki Nal	PALI	Desuri	Luni	Sukri	MINOR	25.245481	73.573881	13.80	1,708.00	2.27	2.28	NA	509.40	5,540.00	511.11	414.00	343.01
2598	Balla ki Dhani Bandh	PALI	Pali	Luni	Sukri	MINOR	25.640896	73.196740				0.83					160.00	
2694	Boki ka Bala	PALI	Pali	Luni	Sukri	Minor	25.616708	73.217954	9.75	1,097.00	48.00	1.28	NA	189.84	3,658.00	205.00	124.00	120.00
2613	Endla	PALI	Pali	Luni	Sukri	MINOR	25.538750	73.256202	4.70	5,400.00		6.03		334.00	3.60	810.00	688.00	607.00
2622	Gundoj Bandh	PALI	Pali	Luni	Sukri	MINOR	25.611234	73.313818	3.65	2,400.00	5.00	0.68	-	70.75	1.98	91.00	80.00	57.00
2699	Knatra Phutiyasar	PALI	Pali	Luni	Sukri	Minor	25.728300	73.273019				0.54					92.80	
2649	Manihari Bundh	PALI	Pali	Luni	Sukri	MINOR	25.658620	73.085174	4.70	2,940.00	1.50	1.50	-	142.63	3.66	53.00	51.00	30.00
2672	Sali Ki Dhani	PALI	Pali	Luni	Sukri	MINOR	25.573484	73.126664	4.70	3,075.00	1.55	1.33		401.75	5.13	384.00	125.00	259.00
2691	Dhani	PALI	Rani	Luni	Sukri	Minor	25.386370	73.301095	8.00	2,610.00	0.94	0.93	NA	92.22	3,340.00	299.00	222.90	135.00
2610	Dhariya	PALI	Rani	Luni	Sukri	MINOR	25.469906	73.406159				7.95					1,724.00	
2620	Guda Gopinath Bandh	PALI	Rani	Luni	Sukri	MINOR	25.390148	73.475619	8.07	18.00	0.37	0.25	NA	28.30	1,350.00	199.60	80.00	84.00
2697	Dedwan	PALI	Rohat	Luni	Sukri	Minor	25.618412	73.015628	11.90	51.00	0.57	0.56	NA	53.62	900.00	141.36	107.00	80.40
2687	Vayad	PALI	Rohat	Luni	Sukri	MINOR	25.732365	72.956612	4.80	3,350.00	1.44	1.40		1,296.73	3.36	368.00	219.00	263.00
2606	Chanod	PALI	Sumerpur	Luni	Sukri	MINOR	25.530511	73.141231	700.00	1,700.00	1.10	1.10	180.00	2,552.00	2,700.00	280.00	136.00	136.00
	Sub Basin Total										**85.22**	**52.59**				**8,875.42**	**9,921.50**	**5,407.46**
777	Pariharo kan khadeen (Kotra)	BARMER	Siwana	Luni	Sukri (Sayala)	MINOR	25.433966	72.316086	3.90	990.00	0.04	0.04	-	23.12	-	15.00	15.00	15.00
2004	Hemaguda X bund	JALORE	Chitalwana	Luni	Sukri (Sayala)	MINOR	25.026096	71.766453	3.58	146.39	2.75	2.75	7.48				480.15	480.15
2106	Vomal X bund	JALORE	Chitalwana	Luni	Sukri (Sayala)	MINOR	25.057239	71.866672	5.49	176.88	2.77	2.77	4.28				580.15	580.15
2107	Zhab X bund	JALORE	Chitalwana	Luni	Sukri (Sayala)	MINOR	25.029390	71.832352	4.72	2,250.00	2.58	2.58	9.15				500.00	500.00
1965	Bal samand bund	JALORE	Jaswantpura	Luni	Sukri (Sayala)	MINOR	25.138405	72.362266				2.53					330.00	
	Sub Basin Total										**8.13**	**10.66**				**15.00**	**1,905.30**	**1,575.30**
	Basin Total										**1,253.30**	**558.74**				**69,169.16**	**108,223.68**	**55,963.52**
534	Badiyala	BANSWARA	Anandpuri	Mahi	Anas	MINOR	23.419203	74.129086	12.20	NA	0.45	0.40	NA	NA	NA	81.00	65.00	45.00
540	Bhanwaria Ka naka	BANSWARA	Anandpuri	Mahi	Anas	MINOR	23.390861	74.097021	15.00	722.00	0.59	0.57		111.00	3.36	142.91	136.00	82.00
538	Bhuwanpura	BANSWARA	Anandpuri	Mahi	Anas	MINOR	23.446963	74.191226				0.19					36.00	
569	Kajaliya	BANSWARA	Anandpuri	Mahi	Anas	MINOR	23.424763	74.148705	10.00	435.00	0.49	0.45	NA	50.09	NA	105.00	36.00	64.00
626	Nava Tapra	BANSWARA	Anandpuri	Mahi	Anas	Minor	23.421575	74.071212	NA	NA	0.19	0.16	NA	28.47	NA	NA	40.00	NA
602	Sundrao	BANSWARA	Anandpuri	Mahi	Anas	MINOR	23.403793	74.112817	10.20	434.00	0.32	0.29	NA	61.13	1.35	37.00	34.00	33.00
606	Udaipura Bada	BANSWARA	Anandpuri	Mahi	Anas	MINOR	23.410741	74.191980	10.00	215.00	0.27	0.25	NA	50.09	NA	54.00	40.00	36.00
613	Aryapada	BANSWARA	Bagidora	Mahi	Anas	Minor	23.337924	74.192964	12.25	608.00	0.31	0.56	NA	38.57	2.34	130.00	123.00	80.00
541	Bhura Kuwr	BANSWARA	Bagidora	Mahi	Anas	MINOR	23.318704	74.245126	12.00	276.00	0.41	0.38	NA	36.51	2.55	77.00	76.00	44.00
558	Deoki ka Naka	BANSWARA	Bagidora	Mahi	Anas	MINOR	23.328271	74.192958	18.50	253.50	0.55	0.49		40.41	2.40	86.00	28.73	92.07
559	Gangar-Talai	BANSWARA	Bagidora	Mahi	Anas	MINOR	23.239066	74.169733	8.00	NA	0.32	0.28	NA	NA	NA	67.00	52.00	32.00
570	Kalinjra	BANSWARA	Bagidora	Mahi	Anas	MINOR	23.350939	74.307367	11.78	1,835.00	9.59	9.29		429.25	13.65	2,119.00	1,897.00	1,879.02

S. No.	Project Name	District	Block	Basin	Sub-basin	Class	Latitude (DD)	Longitude (DD)	Ht. above Lowest Foundation (m)	Length of Dam (m)	Gross Storage Capacity (Mm^3)	Live Storage Capacity (Mm^3)	Reservoir Area at FRL (km^2)	Design Spilway Capacity (cusecs)	Length of Canal System (km)	Command Area (ha)		
																GCA	CCA	ICA
1	2	3	4	5	6	7	9	10	11	12	13	14	15	16	17	18	19	20
624	Khodalim	BANSWARA	Bagidora	Mahi	Anas	Minor	23.312225	74.202233	NA	NA	0.54	0.49	NA	128.14	NA	NA	28.00	NA
590	Panchal	BANSWARA	Bagidora	Mahi	Anas	MINOR	23.332650	74.214400	15.10	370.00	0.93	0.93		94.35	4.89	163.00	125.00	119.00
627	Ram Ka Munna	BANSWARA	Bagidora	Mahi	Anas	Minor	23.255460	74.146286	12.00	61.50	0.33	0.28	NA	NA	NA	42.00	42.00	NA
630	Shergarh Khunta	BANSWARA	Bagidora	Mahi	Anas	Minor	23.339659	74.168896	NA	NA	1.18	1.12	NA	NA	NA	NA	80.97	NA
531	Akheypura	BANSWARA	Kushalgarh	Mahi	Anas	MINOR	23.186841	74.476936	5.50	240.00	0.52	0.50	NA	38.77	1.80	83.00	69.00	55.00
548	Budawa	BANSWARA	Kushalgarh	Mahi	Anas	MINOR	23.231721	74.413775	7.70	590.00	0.43	0.40	NA	45.48	1.83	85.00	30.00	57.00
552	Charkhani	BANSWARA	Kushalgarh	Mahi	Anas	MINOR	23.323651	74.399234	19.25	274.50	1.09	0.97	NA	101.12	3.23	227.00	198.00	302.00
560	Ghoradhara	BANSWARA	Kushalgarh	Mahi	Anas	MINOR	23.208833	74.495812	13.40	396.00	1.34	1.26	NA	86.03	5.79	355.00	245.00	134.00
566	Jhakriya	BANSWARA	Kushalgarh	Mahi	Anas	MINOR	23.163398	74.437232	12.90	192.00	0.29	0.23	NA	30.79	1.95	67.00	55.00	41.00
568	Jhikli	BANSWARA	Kushalgarh	Mahi	Anas	MINOR	23.249547	74.442598	8.50	755.00	0.48	0.45	NA	45.28	1.26	116.00	108.00	66.00
584	Nagda	BANSWARA	Kushalgarh	Mahi	Anas	MINOR	23.150889	74.483018	17.30	407.00	1.44	1.34	NA	87.31	3.60	371.00	276.00	171.00
594	Ramgarh	BANSWARA	Kushalgarh	Mahi	Anas	MINOR	23.146728	74.493791	10.52	178.00	0.26	0.23	NA	25.75	0.75	49.00	42.00	34.00
595	Rasodi	BANSWARA	Kushalgarh	Mahi	Anas	MINOR	23.115432	74.406277	7.60	396.00	0.24	0.23	NA	22.64	0.76	39.00	34.00	26.00
629	Saran patela Ka Naka	BANSWARA	Kushalgarh	Mahi	Anas	Minor	23.270853	74.431386	12.54	165.00	0.54	0.54	NA	54.45	2.40	136.00	128.34	73.00
601	Sonaria	BANSWARA	Kushalgarh	Mahi	Anas	MINOR	23.224805	74.472271	15.00	668.50	4.25	3.77		233.16	6.66	912.00	771.00	785.93
605	Udaigarh Vasuni	BANSWARA	Kushalgarh	Mahi	Anas	MINOR	23.172097	74.430033				0.17					15.78	
532	Andeshver	BANSWARA	Sajjangarh	Mahi	Anas	MINOR	23.293937	74.372509	8.80	261.00	0.52	0.51	NA	39.11	1.71	38.00	26.00	24.00
608	Badwas	BANSWARA	Sajjangarh	Mahi	Anas	Minor	23.211569	74.378340	7.60	817.00	0.25	0.20	NA	24.17	0.60	53.00	50.61	30.00
539	Bhamri Tandi	BANSWARA	Sajjangarh	Mahi	Anas	MINOR	23.269570	74.342439	17.00	464.00	2.50	2.26		157.07	8.37	448.00	403.00	395.80
544	Biyapada	BANSWARA	Sajjangarh	Mahi	Anas	MINOR	23.158307	74.368228	15.00	686.00	4.93	4.74		260.61	9.90	692.00	1,000.00	445.00
616	Chanawala	BANSWARA	Sajjangarh	Mahi	Anas	Minor	23.338553	74.317314	NA	NA	0.23	0.21	NA	NA	NA	NA	36.84	NA
549	Chandela	BANSWARA	Sajjangarh	Mahi	Anas	MINOR	23.254632	74.266434	-	-	0.23	0.50	4.00		-	-	95.00	-
553	Chatra kunta	BANSWARA	Sajjangarh	Mahi	Anas	MINOR	23.179214	74.272880	15.34	388.00	1.15	1.07	NA	95.09	3.66	203.00	191.00	153.00
554	Choti Tandi	BANSWARA	Sajjangarh	Mahi	Anas	MINOR	23.152474	74.290700				1.70					367.00	
563	Goyaka Parsad	BANSWARA	Sajjangarh	Mahi	Anas	MINOR	23.191466	74.290266	14.41	608.00	2.22	1.90		140.37	7.30	494.00	444.00	271.15
564	Himmatgarhi	BANSWARA	Sajjangarh	Mahi	Anas	MINOR	23.117889	74.360871	12.84	679.00	1.85	1.60		147.02	4.62	345.00	302.00	229.46
577	Magerda	BANSWARA	Sajjangarh	Mahi	Anas	MINOR	23.255908	74.379392	NA	366.00	0.23	0.21	NA	45.28	1.80	77.00	73.00	58.00
582	Maska	BANSWARA	Sajjangarh	Mahi	Anas	MINOR	23.130832	74.348636	12.20	265.00	0.57	0.55	NA	45.28	0.99	115.00	110.00	79.00
587	Navagaon	BANSWARA	Sajjangarh	Mahi	Anas	MINOR	23.213833	74.353253	15.17	426.00	1.46	1.31	NA	95.09	2.10	256.00	234.00	187.00
597	Sajjangarh	BANSWARA	Sajjangarh	Mahi	Anas	MINOR	23.260889	74.292669	9.15	895.00	0.29	0.26	NA	62.85	0.99	51.00	41.00	37.00
604	Timba Mahudi	BANSWARA	Sajjangarh	Mahi	Anas	MINOR	23.262115	74.344262				0.35					71.00	
	Sub Basin Total										**43.76**	**43.60**				**8,315.91**	**8,256.27**	**6,160.43**
1757	Amarpura	DUNGARPUR	Simalwara	Mahi	Bhadar	MINOR	23.480405	73.808660	20.02	423.00	15.20	13.59	3.22	41.26	37.77	1,799.00	1,601.00	1,820.00
1763	Bhadar	DUNGARPUR	Simalwara	Mahi	Bhadar	MINOR	23.564096	73.839433	14.32	1,035.00	4.75	4.30	1.34	9.32	19.00	875.00	670.00	535.00
1782	Gallon	DUNGARPUR	Simalwara	Mahi	Bhadar	MINOR	23.543702	73.782880	11.53	183.00	0.38	0.31	8.00	77.00	2.91	45.00	41.00	32.00
1843	Watota	DUNGARPUR	Simalwara	Mahi	Bhadar	Minor	23.470469	73.777340	-	390.00	0.22	1.32	N.A.	1,830.00	2.01	99.00	299.05	75.00
	Sub Basin Total										**20.55**	**19.52**				**2,818.00**	**2,611.05**	**2,462.00**
1629	Munjwa	CHITTAURGARH	Bari Sadri	Mahi	Jakham	MINOR	24.323481	74.474607	9.37	0.32	0.53	0.46	-	60.56	1.41	70.00	160.00	53.04
1795	Kamalia	DUNGARPUR	Aspur	Mahi	Jakham	MINOR	23.936054	74.315599	10.32	125.00	0.34	0.30			1.44	87.00	74.00	48.00
1797	Kanodia	DUNGARPUR	Aspur	Mahi	Jakham	MINOR	23.915922	74.242796	10.02	318.00	0.53	0.52			2.40	90.00	74.00	80.00
2707	Basera Upper	PRATAPGARH	Chhoti Sadri	Mahi	Jakham	MINOR	24.443187	74.656704				0.15					16.00	
2720	Madura	PRATAPGARH	Chhoti Sadri	Mahi	Jakham	MINOR	24.240685	74.671506				0.07					19.00	
2709	Delva	PRATAPGARH	Dhariawad	Mahi	Jakham	MINOR	23.992730	74.280330	12.00	100.00	0.73	0.66		98.20	3.16	164.08	128.00	96.04
2713	Gagri	PRATAPGARH	Dhariawad	Mahi	Jakham	MINOR	24.133581	74.300549	15.00	615.00	6.41	5.66		708.07	17.30	1,310.00	1,080.00	647.92
2714	Gopalpur	PRATAPGARH	Dhariawad	Mahi	Jakham	MINOR	24.177778	74.418056	17.00	501.00	0.20	0.15	NA	67.52	2.44	29.00	29.00	23.00
2716	Karmari pick up weir	PRATAPGARH	Dhariawad	Mahi	Jakham	MINOR	24.158398	74.467172				4.73					676.00	
1688	Khoki	PRATAPGARH	Dhariawad	Mahi	Jakham	Minor	24.133887	74.322362	18.10	200.00	2.01	1.61	28.60	2,021.00		423.00	551.00	496.00
2723	Naaglia pick up weir	PRATAPGARH	Dhariawad	Mahi	Jakham	MINOR	24.159203	74.516948				5.00					715.00	
2727	Talaya	PRATAPGARH	Pratapgarh	Mahi	Jakham	MINOR	24.215723	74.679484				1.00					481.00	
2728	Tejad	PRATAPGARH	Pratapgarh	Mahi	Jakham	MINOR	24.017019	74.693152	5.72	0.37	0.29	0.13	-	12.57	0.70	55.00	19.00	40.49
3298	Rawat bore	UDAIPUR	Lasadiya	Mahi	Jakham	MINOR	24.274531	74.293720	19.20	195.00	2.67	2.36		250.23	15.69	617.00	482.00	553.79
3317	Tarkati ka naka	UDAIPUR	Lasadiya	Mahi	Jakham	MINOR	24.283044	74.283465	9.00	240.80	0.35	0.34		53.63	3.87	116.60	74.00	39.00
3214	Dagocha	UDAIPUR	Salumbar	Mahi	Jakham	MINOR	23.933959	74.248778	8.80		0.72	0.31		41.23	6.99	165.07	149.00	89.00
3279	Manpur	UDAIPUR	Salumbar	Mahi	Jakham	MINOR	24.011111	74.255556	10.50	258.50	3.61	2.95		226.56	12.30	664.00	597.00	418.00
	Sub Basin Total										**18.38**	**26.40**				**3,790.75**	**5,324.00**	**2,584.28**
612	Amba	BANSWARA	Anandpuri	Mahi	Mahi	Minor	23.351162	74.081228	NA	NA	0.32	0.29	NA	NA	NA	NA	69.00	NA
622	Jher	BANSWARA	Anandpuri	Mahi	Mahi	Minor	23.333913	74.070913	12.50	756.00	1.03	0.97	NA	156.13	6.33	246.00	199.19	159.00
536	Barigama	BANSWARA	Bagidora	Mahi	Mahi	MINOR	23.357034	74.400950	15.40	340.00	0.81	0.79	NA	76.69	3.93	196.00	172.00	113.00
542	Bhutpada	BANSWARA	Bagidora	Mahi	Mahi	MINOR	23.371809	74.398462	9.60	1,405.00	1.14	1.03	NA	91.69	4.74	209.00	194.00	155.00
571	Kejri	BANSWARA	Bagidora	Mahi	Mahi	MINOR	23.404154	74.393712	7.00	810.00	0.25	0.25	NA	52.07	0.60	65.00	57.00	28.00
576	Lalaheda	BANSWARA	Bagidora	Mahi	Mahi	MINOR	23.408109	74.403778	6.37	449.00	0.41	0.36	NA	38.60	0.67	115.00	85.00	51.00
537	Berwala Machar	BANSWARA	Banswara	Mahi	Mahi	MINOR	23.365854	74.460305				0.16					38.00	
546	Borkhaber	BANSWARA	Banswara	Mahi	Mahi	MINOR	23.354241	74.433693				1.09					194.00	
550	Chaperiya	BANSWARA	Banswara	Mahi	Mahi	MINOR	23.389626	74.545202	13.85	306.50	0.68	0.67	NA	53.54	4.20	148.00	136.00	95.00
556	Dabrimal	BANSWARA	Banswara	Mahi	Mahi	MINOR	23.344273	74.467521	NA	NA	0.30	0.27	NA	33.68	NA	NA	49.00	NA
557	Deogarh	BANSWARA	Banswara	Mahi	Mahi	MINOR	23.456717	74.527961	NA	NA	0.38	0.35	NA	32.83	NA	NA	60.00	NA
567	Jhemiya	BANSWARA	Banswara	Mahi	Mahi	MINOR	23.428995	74.564258				0.45					61.00	

S. No.	Project Name	District	Block	Basin	Sub-basin	Class	Latitude (DD)	Longitude (DD)	Ht. above Lowest Foundation (m)	Length of Dam (m)	Gross Storage Capacity (Mm^3)	Live Storage Capacity (Mm^3)	Reservoir Area at FRL (km^2)	Design Spilway Capacity (cusecs)	Length of Canal System (km)	Command Area (ha)		
																GCA	CCA	ICA
1	2	3	4	5	6	7	9	10	11	12	13	14	15	16	17	18	19	20
578	Maheshpura	BANSWARA	Banswara	Mahi	Mahi	MINOR	23.355653	74.528428	NA	NA	0.32	0.30	NA	55.24	NA	NA	74.00	NA
580	Mahuwal Bhungda	BANSWARA	Banswara	Mahi	Mahi	MINOR	23.388889	74.508333	12.10	655.00	0.66	0.65	NA	61.35	3.00	96.00	96.00	74.00
585	Nalda	BANSWARA	Banswara	Mahi	Mahi	MINOR	23.393403	74.519843	NA	39.20	0.51	0.50	NA	60.36	1.11	NA	101.00	71.00
586	Nathpura Kherwali	BANSWARA	Banswara	Mahi	Mahi	MINOR	23.450297	74.585618	14.30	212.00	0.28	0.26	NA	59.49	1.50	54.00	40.00	36.00
588	Nawa Kheda	BANSWARA	Banswara	Mahi	Mahi	MINOR	23.423743	74.499603	9.61	215.10	0.22	0.20		32.88	1.10	45.00	14.97	58.00
589	Padla	BANSWARA	Banswara	Mahi	Mahi	MINOR	23.513997	74.350470	9.45	103.60	0.21	0.21	NA	26.26	1.20	54.00	48.00	29.00
611	Sagbari	BANSWARA	Banswara	Mahi	Mahi	Minor	23.489763	74.363482	8.50	NA	0.65	0.55	NA	58.86	NA	95.00	89.88	58.00
628	Salia	BANSWARA	Banswara	Mahi	Mahi	Minor	23.460819	74.388631	7.20	183.00	0.31	0.27	NA	103.30	1.38	43.00	35.22	31.00
598	Samriya	BANSWARA	Banswara	Mahi	Mahi	MINOR	23.428026	74.421039				0.83					140.00	
607	Wageri	BANSWARA	Banswara	Mahi	Mahi	MINOR	23.389299	74.506171	19.64	498.00	2.39	2.16		160.21	4.77	422.00	392.00	308.79
535	Baridanpur	BANSWARA	Chhoti Sarwan	Mahi	Mahi	MINOR	23.506871	74.679009	12.80	318.00	0.30	0.29	NA	45.28	1.50	63.00	54.00	42.00
615	Bhatia	BANSWARA	Chhoti Sarwan	Mahi	Mahi	Minor	23.535070	74.656513	14.25	880.00	1.08	0.99	NA	120.87	1.69	187.00	176.92	182.00
621	Ghori Tejpur	BANSWARA	Chhoti Sarwan	Mahi	Mahi	Minor	23.621575	74.673010	10.05	192.00	0.54	0.48	NA	51.93	1.44	111.00	110.12	69.00
579	Mahudi Kheda	BANSWARA	Chhoti Sarwan	Mahi	Mahi	MINOR	23.554907	74.661070	17.00	915.00	1.49	1.49		94.35	4.32	386.00	298.60	239.00
593	Phephar	BANSWARA	Chhoti Sarwan	Mahi	Mahi	MINOR	23.503071	74.648130	12.25	298.00	0.51	0.47		34.16	2.61	95.00	34.46	81.00
596	Runjiya-Danpur	BANSWARA	Chhoti Sarwan	Mahi	Mahi	MINOR	23.537488	74.720822	15.56	197.00	0.68	0.60	NA	60.79	3.87	274.00	103.00	120.00
614	Bhagora	BANSWARA	Garhi	Mahi	Mahi	Minor	23.591655	74.197953	9.87	1,143.00	3.24	2.56	N.A.	10,575.00	13.56	628.00	574.00	292.00
620	Footan	BANSWARA	Garhi	Mahi	Mahi	Minor	23.572144	74.231429	10.28	756.00	3.35	3.06	N.A.	11,520.00	11.67	588.00	546.00	437.00
610	Naya Talab	BANSWARA	Garhi	Mahi	Mahi	Minor	23.593749	74.240742	7.60	300.00	0.20	0.10	NA	26.91	0.75	47.00	17.00	24.00
545	Borda	BANSWARA	Ghatol	Mahi	Mahi	MINOR	23.779712	74.310332	10.80	320.00	1.19	1.00	NA	64.52	6.84	298.00	214.00	136.00
547	Borpi-Kerig	BANSWARA	Ghatol	Mahi	Mahi	MINOR	23.866667	74.498611	11.30	274.00	0.51	0.50	NA	41.66	3.90	163.00	119.00	71.00
551	Chapron ka Naka	BANSWARA	Ghatol	Mahi	Mahi	MINOR	23.843471	74.466618	9.75	280.00	0.20	0.19	NA	27.17	5.55	37.00	31.00	26.00
617	Chirola	BANSWARA	Ghatol	Mahi	Mahi	Minor	23.740746	74.287292	NA	NA	0.34	0.31	NA	NA	NA	NA	22.27	NA
555	Cundai	BANSWARA	Ghatol	Mahi	Mahi	MINOR	23.812297	74.491419	14.77	310.00	0.53	0.47	NA	64.89	2.70	237.00	115.34	166.00
618	Delwara	BANSWARA	Ghatol	Mahi	Mahi	Minor	23.832250	74.389778				1.75					328.00	
619	Dudkaii	BANSWARA	Ghatol	Mahi	Mahi	Minor	23.811771	74.338095	15.85	332.00	1.27	1.08	NA	102.47	4.87	251.00	207.00	155.00
562	Gorcha	BANSWARA	Ghatol	Mahi	Mahi	MINOR	23.811150	74.508737	11.94	320.00	0.86	0.84	NA	174.33	2.10	167.00	187.00	109.00
609	Haro	BANSWARA	Ghatol	Mahi	Mahi	Minor	23.770139	74.392187				11.66					1,845.00	
565	Jagpura	BANSWARA	Ghatol	Mahi	Mahi	MINOR	23.856034	74.352605	13.10	555.00	1.48	1.47	NA	110.37	4.26	304.00	266.00	170.00
623	Khatia	BANSWARA	Ghatol	Mahi	Mahi	Minor	23.742037	74.428405	12.50	180.00	1.39	1.32	NA	108.22	NA	304.00	265.99	188.00
575	Kundla	BANSWARA	Ghatol	Mahi	Mahi	MINOR	23.836304	74.330662	7.00	NA	0.64	0.64	NA	72.17	NA	135.00	121.00	74.00
581	Mahuwal Delwara	BANSWARA	Ghatol	Mahi	Mahi	MINOR	23.838299	74.390234	9.15	300.00	0.21	0.20	NA	47.40	1.02	34.00	32.00	23.00
625	Makanpura	BANSWARA	Ghatol	Mahi	Mahi	Minor	23.804625	74.427341	12.19	1,845.00	4.87	4.64	N.A.	6,432.00	6.30	503.56	460.00	437.00
583	Memkhore	BANSWARA	Ghatol	Mahi	Mahi	MINOR	23.654302	74.461198	NA	255.00	4.20	3.58		174.33	9.00	877.00	723.00	364.23
592	Phata	BANSWARA	Ghatol	Mahi	Mahi	MINOR	23.815658	74.302676	9.15	208.00	0.52	0.47	NA	64.30	3.51	98.00	98.00	67.00
600	Sompura	BANSWARA	Ghatol	Mahi	Mahi	MINOR	23.660529	74.519150	7.60	84.00	0.33	0.29	NA	41.18	0.42	46.00	41.00	22.00
603	Syhampura	BANSWARA	Ghatol	Mahi	Mahi	MINOR	23.905320	74.457964				0.44					117.00	
631	Vareth	BANSWARA	Ghatol	Mahi	Mahi	Minor	23.833746	74.488008	11.20	380.00	0.63	0.51	NA	72.79	4.35	117.00	91.90	74.00
533	Badi Serwa	BANSWARA	Kushalgarh	Mahi	Mahi	MINOR	23.208053	74.678054	6.00	NA	0.22	0.18	NA	27.17	NA	44.00	42.00	25.00
543	Bijori	BANSWARA	Kushalgarh	Mahi	Mahi	MINOR	23.272638	74.567729	11.80	177.00	0.37	0.35	NA	33.65	1.77	84.00	66.00	50.00
561	Gopal Pura	BANSWARA	Kushalgarh	Mahi	Mahi	MINOR	23.226993	74.560882	10.35	823.00	1.23	1.11		87.42	4.92	287.00	64.88	160.00
572	Karmdiya	BANSWARA	Kushalgarh	Mahi	Mahi	MINOR	23.186963	74.637224	8.60	490.00	0.63	0.57	NA	58.69	2.70	178.00	118.00	83.00
573	Khanapada	BANSWARA	Kushalgarh	Mahi	Mahi	MINOR	23.167349	74.565792	10.70	300.00	0.46	0.44	NA	38.26	2.25	1.33	129.00	64.00
574	Kheriyapada	BANSWARA	Kushalgarh	Mahi	Mahi	MINOR	23.196464	74.615479	8.20	189.00	0.38	0.34	NA	35.12	1.50	85.00	78.00	55.00
591	Panda	BANSWARA	Kushalgarh	Mahi	Mahi	MINOR	23.221516	74.671303	18.30	442.00	1.42	1.34		87.73	6.55	340.00	357.00	290.00
599	Surwan	BANSWARA	Kushalgarh	Mahi	Mahi	MINOR	23.181344	74.566855	10.46	310.00	0.67	0.60	NA	58.02	2.67	144.00	102.00	86.00
1772	Bodigama	DUNGARPUR	Aspur	Mahi	Mahi	MINOR	23.836651	74.091289	12.20	52.40	3.84	4.53		707.00	10.50	350.00	328.00	267.00
1790	Hariyala	DUNGARPUR	Aspur	Mahi	Mahi	MINOR	23.863701	73.970663	8.17	324.00	0.73	0.73			4.80	119.00	88.00	78.00
1798	Kanthri	DUNGARPUR	Aspur	Mahi	Mahi	MINOR	23.915558	73.993995	10.51	209.00	2.55	2.33		159.00	8.34	450.00	419.00	384.00
1800	Khankan	DUNGARPUR	Aspur	Mahi	Mahi	MINOR	23.869407	74.304293	8.83	340.00	0.56	0.51			4.02	165.00	139.00	77.00
1805	Laxmisore	DUNGARPUR	Aspur	Mahi	Mahi	MINOR	23.863889	74.087500	8.50	515.00	0.73	0.70			1.20	103.00	79.00	35.00
1807	Machelia	DUNGARPUR	Aspur	Mahi	Mahi	MINOR	23.922013	74.352830	10.88	302.00	0.34	0.30			1.15	67.00	49.00	44.00
1814	Movai	DUNGARPUR	Aspur	Mahi	Mahi	MINOR	23.852631	73.999988	5.90	961.00	0.85	1.03			3.90	132.00	132.00	96.00
1816	Pachiasa	DUNGARPUR	Aspur	Mahi	Mahi	MINOR	23.890247	74.108325	7.10	520.00	1.36	1.25			3.18	229.00	188.00	
1822	Punjpur	DUNGARPUR	Aspur	Mahi	Mahi	MINOR	23.879722	74.022733	7.62	205.00	2.60	3.34		360.71	12.60	599.00	582.00	469.00
1793	Jogiwara	DUNGARPUR	Dungarpur	Mahi	Mahi	MINOR	23.822600	73.936743	8.63	251.00	0.45	0.29			1.50	63.90	49.00	66.00
1802	Kolkhanda	DUNGARPUR	Dungarpur	Mahi	Mahi	MINOR	23.810812	73.948805	9.90	175.00	0.35	0.31			1.10	30.00	23.00	20.00
1756	Akhaypur	DUNGARPUR	Sagwara	Mahi	Mahi	MINOR	23.781217	74.001053	4.30	360.00	1.30	1.19	25.91	83.00	4.19	156.00	130.00	40.00
1764	Bhaga Memor	DUNGARPUR	Sagwara	Mahi	Mahi	MINOR	23.652561	74.114879	8.80	294.00	0.23	0.21	8.00	27.00	2.07	52.00	40.00	24.00
1765	Bhasore	DUNGARPUR	Sagwara	Mahi	Mahi	MINOR	23.788997	73.969116	14.00	269.00	1.42	1.27	42.60	135.00	5.67	255.00	213.00	73.00
1767	Bhkuchia	DUNGARPUR	Sagwara	Mahi	Mahi	MINOR	23.736549	74.069297	6.00	200.00	0.38	0.29	7.20		2.55	47.00	36.00	29.00
1778	Dolwario Ka Oda	DUNGARPUR	Sagwara	Mahi	Mahi	MINOR	23.654128	74.119380	10.20	360.00	0.58	0.50	0.17	2.17	2.46	110.50	85.00	76.70
1779	Gada Jhumji	DUNGARPUR	Sagwara	Mahi	Mahi	MINOR	23.719249	74.092095	8.50	506.00	1.25	1.11	0.35	4.02	4.44	267.50	176.00	217.00
1781	Galiyana	DUNGARPUR	Sagwara	Mahi	Mahi	MINOR	23.797268	74.016661	12.72	296.00	1.39	2.23		351.00	9.75	556.00	467.00	352.00
1786	Ghatod	DUNGARPUR	Sagwara	Mahi	Mahi	MINOR	23.791324	74.008886	6.25	1,005.00	0.74	0.68	28.02	228.00	2.88	216.00	140.00	108.00
1791	Jethana	DUNGARPUR	Sagwara	Mahi	Mahi	MINOR	23.651917	74.074688	9.00	285.00	1.30	1.16	53.93	315.00	6.75	351.00	270.00	168.00
1792	Jhanjhari	DUNGARPUR	Sagwara	Mahi	Mahi	MINOR	23.791257	74.046631	9.25		0.77	0.77	148.00	105.35	7.32		138.00	188.00

S. No.	Project Name	District	Block	Basin	Sub-basin	Class	Latitude (DD)	Longitude (DD)	Ht. above Lowest Foundation (m)	Length of Dam (m)	Gross Storage Capacity (Mm^3)	Live Storage Capacity (Mm^3)	Reservoir Area at FRL (km^2)	Design Spilway Capacity (cusecs)	Length of Canal System (km)	Command Area (ha)		
																GCA	CCA	ICA
1	2	3	4	5	6	7	9	10	11	12	13	14	15	16	17	18	19	20
1812	Mehton Ka Padla	DUNGARPUR	Sagwara	Mahi	Mahi	MINOR	23.590573	73.943706	14.74	353.00	0.80	0.71	28.60	100.00	3.06	219.00	143.00	150.60
1830	Tajore	DUNGARPUR	Sagwara	Mahi	Mahi	MINOR	23.695330	74.043967	12.00	119.00	1.10	1.08	30.77	100.00	1.71	194.00	154.00	77.00
1759	Baba ki Bar	DUNGARPUR	Simalwara	Mahi	Mahi	MINOR	23.527259	73.941096	10.20	105.00	3.13	2.89	1.06	9.42	21.45	625.00	532.00	478.00
1766	Bhenka Naka	DUNGARPUR	Simalwara	Mahi	Mahi	MINOR	23.447899	73.870731				3.93					447.00	
1836	Chandela	DUNGARPUR	Simalwara	Mahi	Mahi	Minor	23.564649	73.870571	-	-	0.23	0.23	4.00		-	-	20.00	-
1801	Kochari Ambada	DUNGARPUR	Simalwara	Mahi	Mahi	MINOR	23.411076	73.901479	12.92	172.00	0.22	0.21	7.64	36.00	1.93	52.60	38.00	49.00
1826	Semaliya	DUNGARPUR	Simalwara	Mahi	Mahi	MINOR	23.560066	73.954504				0.88					163.00	
2718	Khokharia Ka naka	PRATAPGARH	Dhariawad	Mahi	Mahi	MINOR	23.909722	74.512500	13.50	666.00	0.67	0.62		88.46	3.93	168.29	144.00	89.00
2731	Linknia	PRATAPGARH	Dhariawad	Mahi	Mahi	Minor	23.971161	74.488418	12.00	337.50	0.33	0.31		62.26	0.87	60.26	55.84	36.00
2704	Bakhtod	PRATAPGARH	Peepalkhoont	Mahi	Mahi	MINOR	23.752470	74.620391	17.23	425.00	1.44	1.34		119.31	6.83	221.00	78.00	201.00
2711	Dunglawani	PRATAPGARH	Peepalkhoont	Mahi	Mahi	MINOR	23.728197	74.720606	18.60	213.00	1.59	1.47	NA	260.36	6.78	252.00	229.00	210.00
2715	Kali Ghati	PRATAPGARH	Peepalkhoont	Mahi	Mahi	MINOR	23.718937	74.617937	14.80	493.00	0.80	0.71		89.77	4.08	143.00	53.41	132.00
2719	Lamba-Debra	PRATAPGARH	Peepalkhoont	Mahi	Mahi	MINOR	23.852655	74.627186	13.90	465.00	1.25	1.20	NA	116.03	2.40	266.00	234.00	105.00
2721	Male	PRATAPGARH	Peepalkhoont	Mahi	Mahi	MINOR	23.829167	74.581944	17.00	563.00	5.64	5.11		407.52	7.92	1,281.00	1,076.00	584.39
2722	Morwania	PRATAPGARH	Peepalkhoont	Mahi	Mahi	MINOR	23.759722	74.570833	11.11	453.80	1.15	1.11	NA	85.13	2.94	203.00	203.00	116.00
2724	Naya Talab	PRATAPGARH	Peepalkhoont	Mahi	Mahi	MINOR	23.679614	74.531934	7.60	300.00	0.20	0.17	NA	26.91	0.75	47.00	40.00	24.00
2726	Sagbari	PRATAPGARH	Peepalkhoont	Mahi	Mahi	MINOR	23.786262	74.577981	8.50	NA	0.65	0.56	NA	58.86	NA	95.00	90.00	58.00
2733	Sodalpur	PRATAPGARH	Peepalkhoont	Mahi	Mahi	Minor	23.815186	74.676975	13.40	250.00	0.70	0.62	NA	95.20	1.83	117.00	113.36	91.00
2732	Amli Kheda	PRATAPGARH	Pratapgarh	Mahi	Mahi	Minor	23.977311	74.803054	18.00	251.50	1.77	1.62	NA	160.06	8.31	321.00	314.00	232.00
2708	Boria	PRATAPGARH	Pratapgarh	Mahi	Mahi	MINOR	23.905832	74.552123	19.35	520.00	4.42	4.10		318.37	2.90	825.00	736.00	583.00
2710	Dharia Kheri	PRATAPGARH	Pratapgarh	Mahi	Mahi	MINOR	23.959620	74.637896				0.39					45.00	
2725	Padlia	PRATAPGARH	Pratapgarh	Mahi	Mahi	MINOR	23.965247	74.747958				1.47					210.00	
	Sub Basin Total										**96.61**	**114.41**				**18,310.94**	**19,390.35**	**11,675.70**
1837	Bor Ka Bhatra	DUNGARPUR	Bichhiwara	Mahi	Moran	Minor	23.775036	73.718649				0.63					134.00	
1785	Genji	DUNGARPUR	Bichhiwara	Mahi	Moran	MINOR	23.718360	73.689079	8.99	386.00	0.65	0.62	20.81	89.00	3.15	140.00	108.00	77.00
1787	Ghorion Ka Naka	DUNGARPUR	Bichhiwara	Mahi	Moran	MINOR	23.708890	73.723939	14.44	206.00	0.63	2.69	21.40	62.00	4.71	140.00	410.00	68.00
1817	Padra	DUNGARPUR	Dungarpur	Mahi	Moran	MINOR	23.734294	73.840247	11.00	172.00	0.39	0.31	11.80	65.00	2.10	72.00	59.00	35.00
1760	Badwas	DUNGARPUR	Sagwara	Mahi	Moran	MINOR	23.584306	74.024133	7.60	817.00	0.25	0.20	NA	24.17	0.60	53.00	51.00	30.00
1770	Billa Badgama	DUNGARPUR	Sagwara	Mahi	Moran	MINOR	23.688129	73.865288	8.90	378.00	0.25	0.25	6.60	61.00	3.29	41.00	33.00	20.00
1773	Borekhed	DUNGARPUR	Sagwara	Mahi	Moran	MINOR	23.638920	73.961084	16.75	177.00	1.28	1.14	36.00	183.00	2.52	263.00	180.00	176.00
1774	Dalyana	DUNGARPUR	Sagwara	Mahi	Moran	MINOR	23.617532	73.966467	-	-	0.66	0.66	21.80	-	-	-	84.00	
1775	Decha	DUNGARPUR	Sagwara	Mahi	Moran	MINOR	23.659012	73.887026	8.27	298.00	0.28	0.27	4.00	42.00	2.39	44.00	34.00	19.00
1784	Garadia	DUNGARPUR	Sagwara	Mahi	Moran	MINOR	23.729723	73.866871	6.00	180.00	0.23	0.21	1.60	49.00	0.72	40.00	8.00	5.00
1804	Laxmansagar	DUNGARPUR	Sagwara	Mahi	Moran	MINOR	23.635349	74.008855	18.60	88.00	4.41	4.11	8.40	367.00	3.29	135.00	43.00	32.00
1841	Lodiser	DUNGARPUR	Sagwara	Mahi	Moran	Minor	23.666035	73.916238	16.02	447.40	11.94	10.05	3.24	50.26	65.94	2,363.00	1,619.00	1,336.00
1806	Loharia	DUNGARPUR	Sagwara	Mahi	Moran	MINOR	23.680556	74.022222	6.00	750.00	0.85	0.71	13.00		4.50	81.00	65.00	49.00
1811	Margia	DUNGARPUR	Sagwara	Mahi	Moran	MINOR	23.743544	73.813678	17.74	360.00	4.90	4.59	1.73	33.39	24.36	1,137.00	866.00	656.00
1819	pdoser	DUNGARPUR	Sagwara	Mahi	Moran	MINOR	23.664572	73.916579				10.05					1,619.00	
1820	Phavata	DUNGARPUR	Sagwara	Mahi	Moran	MINOR	23.655182	73.866156				1.87					322.00	
1831	Tamtia	DUNGARPUR	Sagwara	Mahi	Moran	MINOR	23.708610	73.950531	12.00	750.00	1.20	0.93	1.34	12.08	7.50	865.00	670.00	531.00
1832	Thakroa	DUNGARPUR	Sagwara	Mahi	Moran	MINOR	23.696966	73.968914	7.64	490.00	0.51	0.50	12.00	458.00	3.42	64.00	48.00	48.00
	Sub Basin Total										**28.43**	**39.79**				**5,438.00**	**6,353.00**	**3,082.00**
1769	Bhudan Ka Vela	DUNGARPUR	Aspur	Mahi	Som	MINOR	23.881507	74.164582	10.25	183.00	0.27	0.23			1.02	39.00	39.00	27.00
1777	Dhatana	DUNGARPUR	Aspur	Mahi	Som	MINOR	23.947537	73.968676	10.16	265.00	1.78	1.44			8.64	204.00	196.00	156.00
1783	Ganeshpur	DUNGARPUR	Aspur	Mahi	Som	MINOR	23.947689	73.923486	-	-	0.64	0.57	10.20	49.00	0.90	-	51.00	-
1823	Ramsore	DUNGARPUR	Aspur	Mahi	Som	MINOR	23.961809	73.980988	8.00	169.00	0.26	0.23			1.50	68.00	37.00	42.00
1768	Bhoiyon Ka Naka	DUNGARPUR	Bichhiwara	Mahi	Som	MINOR	23.799174	73.540518	17.45	177.00	0.53	0.49	14.20	85.00	1.58	154.00	133.00	61.00
1788	Googra Pick up weir	DUNGARPUR	Bichhiwara	Mahi	Som	MINOR	23.940346	73.657362	10.30	150.00	0.31	0.27	16.20	633.00	6.00	105.00	81.00	44.00
1789	Gumanpura	DUNGARPUR	Bichhiwara	Mahi	Som	MINOR	23.872884	73.629960	13.17	352.00	1.33	1.23	30.77	102.00	4.95	178.00	154.00	141.00
1839	Khanmal Ka Naka	DUNGARPUR	Bichhiwara	Mahi	Som	Minor	23.839835	73.577463				0.45					25.00	
1803	Kundi Ka Naka	DUNGARPUR	Bichhiwara	Mahi	Som	MINOR	23.749229	73.623367	11.27	274.00	0.70	0.63	26.84	67.00	4.95	167.00	135.00	72.00
1809	Manjola	DUNGARPUR	Bichhiwara	Mahi	Som	MINOR	23.892346	73.591748	10.00	442.00	0.43	0.43	14.60	47.00	2.25	101.00	73.00	50.00
1815	Naval Shyam	DUNGARPUR	Bichhiwara	Mahi	Som	MINOR	23.834802	73.612385	9.45	340.00	1.29	1.23	16.66	123.00	3.27	125.00	84.00	84.00
1825	Shishod	DUNGARPUR	Bichhiwara	Mahi	Som	MINOR	23.916005	73.551793	13.30	138.00	0.95	0.89	29.15	102.00	7.92	195.00	146.00	102.00
1833	Thana Pick up Weir	DUNGARPUR	Bichhiwara	Mahi	Som	MINOR	23.825000	73.661111	3.00	45.00	0.04	0.10	24.29		5.40	157.00	121.00	83.00
1834	Upper Ghodi	DUNGARPUR	Bichhiwara	Mahi	Som	MINOR	23.939247	73.606719	14.00	193.00	2.26	1.98	33.80	2.37	6.66	248.00	169.00	168.00
1762	Bassi	DUNGARPUR	Dungarpur	Mahi	Som	MINOR	23.904079	73.805453	5.51	579.00	0.48	0.40	13.60	110.00	3.75	88.00	68.00	27.00
1838	Faloj	DUNGARPUR	Dungarpur	Mahi	Som	Minor	23.871489	73.868379	7.50	360.00	1.23	1.13	24.29	63.00	4.86	157.20	121.45	68.00
1840	Khempur	DUNGARPUR	Dungarpur	Mahi	Som	Minor	23.931742	73.902559	-	-	0.24	0.24	4.80		-	-	24.00	-
1810	Manpur	DUNGARPUR	Dungarpur	Mahi	Som	MINOR	23.856828	73.777814	6.00	183.00	0.59	0.52	19.23	90.00	1.59	130.67	68.00	108.16
1818	Pagra	DUNGARPUR	Dungarpur	Mahi	Som	MINOR	23.872642	73.829108	7.50	180.00	0.42	0.39	10.00	402.00	2.85	93.00	81.00	57.00
1821	Pholonj	DUNGARPUR	Dungarpur	Mahi	Som	MINOR	23.869197	73.870821				1.13					121.00	
1824	Ransagar	DUNGARPUR	Dungarpur	Mahi	Som	MINOR	23.860569	73.806573	10.00	330.00	1.25	1.13	12.00	365.00	5.40	79.00	61.00	57.00
1842	Savgad	DUNGARPUR	Dungarpur	Mahi	Som	Minor	23.933745	73.871810	-	-	0.23	0.23	4.80		-	-	24.00	-
1827	Singhorion Ka Naka	DUNGARPUR	Dungarpur	Mahi	Som	MINOR	23.919645	73.769288	14.44	206.00	0.63	0.59	21.40	62.00	4.71	140.00	107.00	68.00
1829	Suri	DUNGARPUR	Dungarpur	Mahi	Som	MINOR	23.899421	73.839488	15.00	278.00	2.52	2.24	0.74	9.71	1.35	1,160.00	388.00	257.00
3329	Panund	UDAIPUR	Bhindar	Mahi	Som	Minor	24.357943	74.124370				0.51					115.00	

S. No.	Project Name	District	Block	Basin	Sub-basin	Class	Latitude (DD)	Longitude (DD)	Ht. above Lowest Foundation (m)	Length of Dam (m)	Gross Storage Capacity (Mm^3)	Live Storage Capacity (Mm^3)	Reservoir Area at FRL (km^2)	Design Spilway Capacity (cusecs)	Length of Canal System (km)	Command Area (ha)		
																GCA	CCA	ICA
1	2	3	4	5	6	7	9	10	11	12	13	14	15	16	17	18	19	20
3292	Phila	UDAIPUR	Bhindar	Mahi	Som	MINOR	24.366667	74.116667				1.36					488.00	
3191	Barapal	UDAIPUR	Girwa	Mahi	Som	MINOR	24.379167	73.629167				0.59					136.00	
3289	Paduna	UDAIPUR	Girwa	Mahi	Som	MINOR	24.284702	73.666518				0.20					117.00	
3327	Velvi	UDAIPUR	Jhadol	Mahi	Som	MINOR	24.212867	73.489958	15.00	180.00	0.25	0.26		62.26	13.00	60.95	53.00	21.00
3203	Bhujda	UDAIPUR	Kherwara	Mahi	Som	MINOR	24.006920	73.517733			0.72	0.72		7.67	2.60		161.00	145.00
3207	Birothi	UDAIPUR	Kherwara	Mahi	Som	MINOR	24.041041	73.466213	18.50		1.68	1.68		464.46	16.52	338.64	254.00	156.00
3218	DoNadi	UDAIPUR	Kherwara	Mahi	Som	MINOR	24.131762	73.408429	24.51	269.00	3.55	2.86		612.00	20.08	398.00	275.00	730.00
3225	Godawari Ka Naka	UDAIPUR	Kherwara	Mahi	Som	MINOR	23.982208	73.564667	21.00		1.46	1.46		373.83	7.44	398.53	277.00	215.00
3259	Koliya	UDAIPUR	Kherwara	Mahi	Som	MINOR	23.995371	73.520495			0.21	0.20		3.03	0.90		23.00	23.00
3318	Thana	UDAIPUR	Kherwara	Mahi	Som	MINOR	23.972552	73.460959	11.00		0.79	0.79		130.50	4.11		70.00	56.00
3213	Chitoria	UDAIPUR	Lasadiya	Mahi	Som	MINOR	24.248056	74.205556	15.00	166.20	0.21	0.20		63.11	1.35	27.72	24.00	23.00
3245	Kali Bhint	UDAIPUR	Lasadiya	Mahi	Som	MINOR	24.325477	74.315757	12.50	170.00	0.24	0.20		257.00	3.26	62.65	42.00	22.00
3248	Kasumbra	UDAIPUR	Lasadiya	Mahi	Som	MINOR	24.258333	74.211111	17.50	113.00	0.31	0.31		76.24	0.30	54.63	45.00	40.47
3252	Kelwa ka vela	UDAIPUR	Lasadiya	Mahi	Som	MINOR	24.273672	74.245888	12.50	117.00	0.23	0.20		722.16	2.60	31.97	59.00	24.00
3253	Kelwa Kanta	UDAIPUR	Lasadiya	Mahi	Som	MINOR	24.307554	74.207007	16.00	195.00	0.35	0.28		67.92		83.37	63.00	40.07
3255	Kesar Sagar	UDAIPUR	Lasadiya	Mahi	Som	MINOR	24.238889	74.105556	15.00	165.00	1.70	1.68		506.87	12.90	489.00	348.00	140.00
3281	Mungli	UDAIPUR	Lasadiya	Mahi	Som	MINOR	24.255556	74.254167	10.25		1.67	1.67		101.95	6.90	337.84	280.00	239.00
3325	Vela	UDAIPUR	Lasadiya	Mahi	Som	MINOR	24.252521	74.233199	11.00	96.00	0.12	0.11		55.47	1.35	53.00	53.00	14.00
3330	Wajna Dam	UDAIPUR	Lasadiya	Mahi	Som	Minor	24.340381	74.290108	20.00	585.00	4.00	3.60		436.44	12.90	1,933.00	736.00	515.18
3201	Bhudhar	UDAIPUR	Rishabhdeo	Mahi	Som	MINOR	24.114704	73.644531	12.25	420.00	1.92	1.81		628.63	14.16	425.00	375.00	259.00
3206	Bilakh	UDAIPUR	Rishabhdeo	Mahi	Som	MINOR	24.112134	73.718203	14.00		0.81	0.94		926.08	10.72	90.93	145.00	107.00
3235	Hathio Ka Naka	UDAIPUR	Rishabhdeo	Mahi	Som	MINOR	24.102367	73.611704	8.50		0.62	0.62		200.23	5.10	101.15	77.00	71.00
3258	Kojawada	UDAIPUR	Rishabhdeo	Mahi	Som	MINOR	24.121496	73.596703	9.00		0.62	0.62		181.96	2.40	130.68	119.00	71.00
3268	Lorda	UDAIPUR	Rishabhdeo	Mahi	Som	MINOR	24.011162	73.786544	14.70	342.00	3.51	3.16		274.70	18.09	779.00	525.00	360.00
3270	Lower Ghori	UDAIPUR	Rishabhdeo	Mahi	Som	MINOR	23.958572	73.691602	9.14	849.00	3.99	3.68		475.77	22.47	934.00	716.00	421.00
3290	Parera	UDAIPUR	Rishabhdeo	Mahi	Som	MINOR	24.154396	73.590990	11.50		0.35	0.35		90.48	7.20	96.70	73.00	51.00
3294	Pilpal Dhara	UDAIPUR	Rishabhdeo	Mahi	Som	MINOR	24.034468	73.741382			0.20	0.20		2.92	1.20		28.00	28.00
3301	Sagwara ki pal	UDAIPUR	Rishabhdeo	Mahi	Som	MINOR	24.194001	73.545816	16.64	95.00	1.58	1.46		589.00	10.95	512.00	303.00	242.00
3312	Similla Mahadeo lift	UDAIPUR	Rishabhdeo	Mahi	Som	MINOR	23.940164	73.739924				8.00					800.00	
3313	Som-pick up weir	UDAIPUR	Rishabhdeo	Mahi	Som	MINOR	23.944802	73.758138	13.50	240.00	Perinal Flow	6.78		3,993.00	20.25	1,215.00	969.00	484.00
3186	Ambamata	UDAIPUR	Salumbar	Mahi	Som	MINOR	24.178546	74.112874	20.60	393.00	3.37	1.10	0.54	438.50	21.30	1,507.00	1,215.00	815.00
3190	Bandora	UDAIPUR	Salumbar	Mahi	Som	MINOR	24.167057	74.096538	11.25	487.00	4.79	4.16		208.00	18.03	1,310.00	979.00	587.00
3227	Gopalpura	UDAIPUR	Salumbar	Mahi	Som	MINOR	24.032269	74.148193				0.01					103.00	
3230	Gudel	UDAIPUR	Salumbar	Mahi	Som	MINOR	24.339520	74.036944	12.50		1.07	1.07		120.22	3.15		280.00	115.00
3243	Jhinjhni	UDAIPUR	Salumbar	Mahi	Som	MINOR	23.941530	74.222865			0.92	0.92		9.25	4.80	104.79	105.00	59.00
3261	Kothar	UDAIPUR	Salumbar	Mahi	Som	MINOR	24.010078	74.201233	8.50		0.54	0.54		71.37	2.70	116.52	97.00	62.00
3273	Madar ka Naka	UDAIPUR	Salumbar	Mahi	Som	MINOR	24.085047	74.181397	8.50	345.00	2.07	1.94		71.36	4.80	439.00	366.00	219.00
3275	Malpur	UDAIPUR	Salumbar	Mahi	Som	MINOR	24.145848	74.139710	11.70	213.00	1.22	1.10		144.10	9.78	Included in Ambamata Project	210.00	Included in Ambamata Project
3303	Salumber	UDAIPUR	Salumbar	Mahi	Som	MINOR	24.138433	74.036632	11.28	457.00	0.85	0.85		250.89	1.65		121.55	
3304	Sanjela	UDAIPUR	Salumbar	Mahi	Som	MINOR	24.040696	74.187995			0.69	0.67	200.00	7.45	1.20		136.00	96.00
3305	Sarvaria	UDAIPUR	Salumbar	Mahi	Som	MINOR	24.048186	74.054016	9.50	731.00	0.41	0.37		75.89	3.00	118.00	75.00	45.00
3321	Tuta mahuda	UDAIPUR	Salumbar	Mahi	Som	MINOR	24.090862	74.107436	9.75		0.16	0.16		55.00	3.24	60.60	34.00	21.00
3184	Adwas	UDAIPUR	Sarada	Mahi	Som	MINOR	24.347070	73.866154	13.50	243.00	2.35	2.21		189.46	8.40	803.00	466.00	223.00
3187	Badghari	UDAIPUR	Sarada	Mahi	Som	MINOR	24.135118	73.889679	7.75		0.57	0.57		47.58	1.77	96.70	80.00	53.00
3189	Balva	UDAIPUR	Sarada	Mahi	Som	MINOR	24.091517	73.774325				0.81					79.00	
3200	Bhorwa	UDAIPUR	Sarada	Mahi	Som	MINOR	24.252209	73.887673				0.05					7.15	
3210	Chawand	UDAIPUR	Sarada	Mahi	Som	MINOR	24.189285	73.775369	14.31	121.00	2.97	2.24	6.45	234.48	8.25	497.00	359.00	251.00
3215	Daya	UDAIPUR	Sarada	Mahi	Som	MINOR	24.255512	73.827878	27.16	1,130.00	12.39	11.22	4.00	630.00	10.00	2,070.00	1,894.00	1,282.00
3216	Delwas	UDAIPUR	Sarada	Mahi	Som	MINOR	24.229900	73.708694				1.00					162.00	
3224	Ghodasagar	UDAIPUR	Sarada	Mahi	Som	MINOR	23.988392	73.848644	11.25		0.30	0.30		115.86	1.95	94.68	78.00	42.00
3234	Harchand	UDAIPUR	Sarada	Mahi	Som	MINOR	24.186989	73.887146	14.25	365.00	7.70	6.29		804.28	15.90	1,034.00	966.00	719.00
3237	Hirnia	UDAIPUR	Sarada	Mahi	Som	MINOR	24.149376	73.763026	14.50		0.45	0.45		116.11	1.56	108..43	82.00	65.00
3249	Katanwara	UDAIPUR	Sarada	Mahi	Som	MINOR	24.180275	73.780151			0.30	0.33	82.00	4.00	0.90		66.00	61.00
3251	Kejar	UDAIPUR	Sarada	Mahi	Som	MINOR	24.177557	73.841657	15.13	823.00	6.34	6.33	1.43	556.20	24.96	809.00	688.00	643.00
3254	Kerpura	UDAIPUR	Sarada	Mahi	Som	MINOR	24.211488	73.858568			0.17	0.17		2.58	0.90		36.00	21.00
3265	Lalar	UDAIPUR	Sarada	Mahi	Som	MINOR	24.146471	73.823222	8.50		0.48	0.47		51.83	4.20	101.15	80.00	53.00
3286	Nathara	UDAIPUR	Sarada	Mahi	Som	MINOR	24.240725	73.708291			0.42	0.43	183.00	5.18	2.34		69.00	62.00
3293	Piladhar	UDAIPUR	Sarada	Mahi	Som	MINOR	24.280477	73.866541			0.63	0.63		6.97	1.14	64.74	61.00	55.00
3309	Semari	UDAIPUR	Sarada	Mahi	Som	MINOR	24.056336	73.886242	17.50	144.00	2.83	2.56		236.16	20.10	1,123.00	678.00	376.00
3310	Shiv Sagar	UDAIPUR	Sarada	Mahi	Som	MINOR	24.050311	73.850137	10.50		0.08	0.08		25.29	1.35	42.08	30.00	18.00
3311	Shyampura	UDAIPUR	Sarada	Mahi	Som	MINOR	24.245833	73.904167			0.89	0.89	385.00	9.04	3.24		149.00	139.00
3315	Surkhan Kheda	UDAIPUR	Sarada	Mahi	Som	MINOR	24.102778	73.866667	13.00		0.50	0.50		77.03	2.10	161.84	57.00	40.00
3320	Tokar	UDAIPUR	Sarada	Mahi	Som	MINOR	23.968855	73.816292	10.00		2.33	2.33		77.03	10.14	258.54	185.00	146.00
	Sub Basin Total										**107.26**	**117.42**				**22,954.27**	**20,250.15**	**12,437.87**

S. No.	Project Name	District	Block	Basin	Sub-basin	Class	Latitude (DD)	Longitude (DD)	Ht. above Lowest Foundation (m)	Length of Dam (m)	Gross Storage Capacity (Mm^3)	Live Storage Capacity (Mm^3)	Reservoir Area at FRL (km^2)	Design Spilway Capacity (cusecs)	Length of Canal System (km)	Command Area (ha)		
																GCA	CCA	ICA
1	2	3	4	5	6	7	9	10	11	12	13	14	15	16	17	18	19	20
	Basin Total										**314.99**	**361.14**				**61,627.88**	**62,184.82**	**38,402.28**
2001	Gomi X bund	JALORE	Chitalwana	Other Nallahs Of Jalore	Other Nallahs Of Jalore	MINOR	24.854382	71.634089	4.94	2,394.00	0.68	0.48	-	289.40	-	-	107.50	107.50
2007	Isrol X bund	JALORE	Chitalwana	Other Nallahs Of Jalore	Other Nallahs Of Jalore	MINOR	24.839035	71.584665			0.18	0.18	-		-	-	41.27	41.20
1970	Bamanwara bund	JALORE	Raniwara	Other Nallahs Of Jalore	Other Nallahs Of Jalore	MINOR	24.634930	72.331395				0.13					17.00	
2111	Gang Tank	JALORE	Raniwara	Other Nallahs Of Jalore	Other Nallahs Of Jalore	Minor	24.735930	72.112501				0.38					75.00	
2010	Jalera bund	JALORE	Raniwara	Other Nallahs Of Jalore	Other Nallahs Of Jalore	MINOR	24.773759	72.169695	7.05	375.64	0.19	0.19	-	18.48		42.00	35.00	26.00
2011	Jetpur bund	JALORE	Raniwara	Other Nallahs Of Jalore	Other Nallahs Of Jalore	MINOR	24.662333	72.287214	11.16	1,240.00	2.50	16.59	0.96	707.00	17.22	2,138.49	1,819.00	2,738.55
2047	Pal bund	JALORE	Raniwara	Other Nallahs Of Jalore	Other Nallahs Of Jalore	MINOR	24.782583	72.117888	7.52	1541 ft.	0.51	0.50	-	76.98			32.37	32.37
2048	Palera bund	JALORE	Raniwara	Other Nallahs Of Jalore	Other Nallahs Of Jalore	MINOR	24.745167	72.123134	7.74	1,463.00	0.83	0.20		271.42	-	113.31	56.00	50.51
2065	Raniwara Khadeen	JALORE	Raniwara	Other Nallahs Of Jalore	Other Nallahs Of Jalore	MINOR	24.774410	72.194614				0.21					56.00	
2075	Santru bund	JALORE	Raniwara	Other Nallahs Of Jalore	Other Nallahs Of Jalore	MINOR	24.795339	72.096224	25.13 ft.	1800 ft	0.51	0.49	-	76.41		83.00	44.00	44.00
1992	Dhamana X bund	JALORE	Sanchore	Other Nallahs Of Jalore	Other Nallahs Of Jalore	MINOR	24.809386	71.781084	3.90	568.00	0.20	0.15	-	51.95	-	-	45.00	45.00
2108	Gundav X bund	JALORE	Sanchore	Other Nallahs Of Jalore	Other Nallahs Of Jalore	Minor	24.805621	72.001250				0.41					35.90	
2002	Hakara X bund	JALORE	Sanchore	Other Nallahs Of Jalore	Other Nallahs Of Jalore	MINOR	24.846774	71.960459	16 ft	8800 ft	1.13	1.13	-	742.87	-	-	110.00	264.00
2008	Jajuson X bund	JALORE	Sanchore	Other Nallahs Of Jalore	Other Nallahs Of Jalore	MINOR	24.751283	71.811259	17.55 ft	3540 ft	1.07	1.07	-	548.34	-	-	142.00	142.00
2009	Jakhal X Bund	JALORE	Sanchore	Other Nallahs Of Jalore	Other Nallahs Of Jalore	MINOR	24.858876	71.802199				0.73					60.12	
2015	Kantol Tank	JALORE	Sanchore	Other Nallahs Of Jalore	Other Nallahs Of Jalore	MINOR	24.743568	71.881350		870 ft	0.06	0.05	-	28.30	-	-	32.77	32.77
2021	Khara X bund	JALORE	Sanchore	Other Nallahs Of Jalore	Other Nallahs Of Jalore	MINOR	24.878020	71.992852				0.26	-	4.76	-	-	56.00	18.00
2028	Lachiwara X bund	JALORE	Sanchore	Other Nallahs Of Jalore	Other Nallahs Of Jalore	MINOR	24.714879	72.014824	21.00 ft	980 ft	0.25	0.22	-	73.01	-	-	57.00	115.00
2033	Lalpura X bund	JALORE	Sanchore	Other Nallahs Of Jalore	Other Nallahs Of Jalore	MINOR	24.683445	71.684652	5.07	2,480.00	0.52	0.43	-	275.00	-	-	151.00	151.00
2039	Meerpura I X bund	JALORE	Sanchore	Other Nallahs Of Jalore	Other Nallahs Of Jalore	MINOR	24.857367	72.000597	5.97	1,337.00	2.51	0.49	-	130.40	-	161.00	145.00	125.00
2044	Nenol X bund	JALORE	Sanchore	Other Nallahs Of Jalore	Other Nallahs Of Jalore	MINOR	24.695994	71.884270	17.50 ft	1730 ft	0.37	0.37	-	872.79	-	-	76.00	178.80
2055	Pur X bund	JALORE	Sanchore	Other Nallahs Of Jalore	Other Nallahs Of Jalore	MINOR	24.821803	71.898114		1010 ft	0.20	0.20	-	13.44	-	-	64.00	
2072	Sankar I X bund	JALORE	Sanchore	Other Nallahs Of Jalore	Other Nallahs Of Jalore	MINOR	24.750000	72.000000	14.62 ft	1300 ft	0.47	0.45	-	60.78	-	-	103.60	103.60
2073	sankar II X bund	JALORE	Sanchore	Other Nallahs Of Jalore	Other Nallahs Of Jalore	MINOR	24.750352	71.992260	14.60 ft	1140 ft	0.34	0.31	-	73.58	-	-	64.00	64.00
2077	Sarnau Tank	JALORE	Sanchore	Other Nallahs Of Jalore	Other Nallahs Of Jalore	MINOR	24.784573	71.949814	17.85 ft	2505 ft	0.85	0.85	-	100.74	-	-	147.00	40.00
2080	Sedia X bund	JALORE	Sanchore	Other Nallahs Of Jalore	Other Nallahs Of Jalore	MINOR	24.829778	71.975464	4.58	3,440.00	1.22	0.87	-	792.85	-	-	64.00	187.45
2088	Surawa X bund	JALORE	Sanchore	Other Nallahs Of Jalore	Other Nallahs Of Jalore	MINOR	24.675349	71.958697				0.51					101.00	101.00
2103	Verol Palader bund	JALORE	Sanchore	Other Nallahs Of Jalore	Other Nallahs Of Jalore	MINOR	24.684840	71.818737	5.80	690.00	0.21	0.21	-	326.00	-	-	35.70	35.70
2104	Vodha I X bund	JALORE	Sanchore	Other Nallahs Of Jalore	Other Nallahs Of Jalore	MINOR	24.857417	71.944687			0.31	0.31					44.53	44.53
2105	Vodha II X bund	JALORE	Sanchore	Other Nallahs Of Jalore	Other Nallahs Of Jalore	MINOR	24.862614	71.946796	15.00 ft	2300 ft	0.14	0.14	-	98.48	-	-	32.37	32.37
	Basin Total										**15.23**	**28.51**				**2,537.80**	**3,850.13**	**4,720.35**
2189	Kirodi	JHUNJHUNUN	Nawalgarh	Outside Basin	Sub 3	Minor	27.738420	75.442100	3.04	490.00	0.26	0.24	NA	40.01	1.72	65.00	64.00	42.00
2190	Kot Sikray	JHUNJHUNUN	Udaipurwati	Outside Basin	Sub 3	Minor	27.715474	75.448525				0.76					24.00	
2933	Hatyas	SIKAR	Piprali	Outside Basin	Sub 3	Minor	27.610809	75.398662	NA	NA	0.40	0.36	NA	43.72		50.00	12.00	43.00
2940	Sikray	SIKAR	Piprali	Outside Basin	Sub 3	Minor	27.655503	75.402771				0.10					24.00	
	Sub Basin Total										**0.66**	**1.46**				**115.00**	**124.00**	**85.00**
1513	Ridmalsar bund	BIKANER	Bikaner	Outside Basin	Sub 4	MINOR	28.034240	73.424867				0.06					12.00	
1514	Sobhasar Bund	BIKANER	Bikaner	Outside Basin	Sub 4	MINOR	28.148697	73.240761				0.05					14.00	
1486	Bhikadai Khadeen	BIKANER	Kolayat	Outside Basin	Sub 4	MINOR	27.786244	72.674218				0.05					11.00	
1488	Chak Bund I	BIKANER	Kolayat	Outside Basin	Sub 4	MINOR	27.841858	72.908223				0.03					75.00	
1489	Chak Bund II	BIKANER	Kolayat	Outside Basin	Sub 4	MINOR	27.815747	72.875639				0.03					59.00	
1490	Chak bund IV	BIKANER	Kolayat	Outside Basin	Sub 4	MINOR	27.838867	72.847270				0.29					12.00	
1491	Chak Bund-II	BIKANER	Kolayat	Outside Basin	Sub 4	MINOR	27.835847	72.883196				0.15					52.00	
1492	Chak Dadar Bund	BIKANER	Kolayat	Outside Basin	Sub 4	MINOR	27.858619	72.860619				0.04					25.00	
1493	Chak Kanya Bund	BIKANER	Kolayat	Outside Basin	Sub 4	MINOR	27.752787	72.811037				0.09					10.50	
1494	Chak Kudi Bund	BIKANER	Kolayat	Outside Basin	Sub 4	MINOR	27.872243	72.815953				0.10					14.00	
1495	Chak Madhosing bund	BIKANER	Kolayat	Outside Basin	Sub 4	MINOR	27.853617	72.800819				0.11					78.50	
1496	Chak Soliya Bund	BIKANER	Kolayat	Outside Basin	Sub 4	MINOR	27.862882	72.828533				0.13					20.00	
1515	Chak Soliya Khadeen	BIKANER	Kolayat	Outside Basin	Sub 4	Minor	27.875128	72.832878				0.13					18.59	
1497	Dand Bund	BIKANER	Kolayat	Outside Basin	Sub 4	MINOR	28.176340	72.400812				0.08					25.00	
1498	Gadiyala bund	BIKANER	Kolayat	Outside Basin	Sub 4	MINOR	27.734467	72.600426				0.14					39.00	
1517	Ganga Sarovar	BIKANER	Kolayat	Outside Basin	Sub 4	Minor	27.950634	72.937555	3.70	3,000.00	1.98	1.38	0.93	326.63	4.32	375.50	395.00	331.50
1500	Gurah Bundh	BIKANER	Kolayat	Outside Basin	Sub 4	MINOR	27.916367	72.800566				0.07					25.60	
1501	Hema Bund	BIKANER	Kolayat	Outside Basin	Sub 4	MINOR	27.750000	72.733333				1.98					566.82	
1503	Kamisar Bund	BIKANER	Kolayat	Outside Basin	Sub 4	MINOR	27.714545	72.777838				0.09					13.46	
1504	Kodamdesar bund	BIKANER	Kolayat	Outside Basin	Sub 4	MINOR	28.046414	73.079608				0.02					25.00	
1505	Mandal Bhatiyan	BIKANER	Kolayat	Outside Basin	Sub 4	MINOR	27.752356	72.706395				0.05					10.50	
1506	Meghwal Khadeen	BIKANER	Kolayat	Outside Basin	Sub 4	MINOR	27.832854	72.887545				0.29					16.30	
1507	Mevali Khadeen	BIKANER	Kolayat	Outside Basin	Sub 4	MINOR	28.239043	72.347410				0.03					9.00	
1508	Mud bund-I	BIKANER	Kolayat	Outside Basin	Sub 4	MINOR	27.877126	72.932319				0.29					80.00	
1509	Mud Bund-II	BIKANER	Kolayat	Outside Basin	Sub 4	MINOR	27.862079	72.918023				0.29					24.00	
1510	Raneji Bund	BIKANER	Kolayat	Outside Basin	Sub 4	MINOR	27.739363	72.744636				0.08					13.40	
1511	Rekha Ranasar Bund	BIKANER	Kolayat	Outside Basin	Sub 4	MINOR	27.963748	72.962203				0.08					13.00	
1512	Revtai Khadeen	BIKANER	Kolayat	Outside Basin	Sub 4	MINOR	28.008055	72.039664				0.07					17.00	
1502	Hoala bund	BIKANER	Nokha	Outside Basin	Sub 4	MINOR	27.660736	73.605352				0.09					24.00	
2932	Ganoda	SIKAR	Danta Ramgarh	Outside Basin	Sub 4	Minor	27.411831	75.267390				0.35					45.00	

S. No.	Project Name	District	Block	Basin	Sub-basin	Class	Latitude (DD)	Longitude (DD)	Ht. above Lowest Foundation (m)	Length of Dam (m)	Gross Storage Capacity (Mm^3)	Live Storage Capacity (Mm^3)	Reservoir Area at FRL (km^2)	Design Spilway Capacity (cusecs)	Length of Canal System (km)	Command Area (ha)		
																GCA	CCA	ICA
1	2	3	4	5	6	7	9	10	11	12	13	14	15	16	17	18	19	20
2934	Kochor	SIKAR	Danta Ramgarh	Outside Basin	Sub 4	Minor	27.447308	75.236564				0.10					19.00	
2937	Reeta	SIKAR	Danta Ramgarh	Outside Basin	Sub 4	Minor	27.413248	75.232152	7.50	660.00	1.03	0.96	0.27	59.47		282.00	276.00	274.00
2938	Sawaipura	SIKAR	Danta Ramgarh	Outside Basin	Sub 4	Minor	27.459928	75.255795	9.60	750.00	0.37	0.28	0.53	58.59	1.86	159.00	137.00	65.00
2935	Mogipura	SIKAR	Khandela	Outside Basin	Sub 4	Minor	27.615784	75.449206				0.87					232.00	
2923	Peepolai Bund	SIKAR	Lachhmangarh	Outside Basin	Sub 4	MINOR	27.656908	74.854813				0.87					64.73	
2931	Baral	SIKAR	Piprali	Outside Basin	Sub 4	Minor	27.580927	75.364104	3.00	610.00	0.21	0.20	0.05	49.10		28.00	12.00	31.08
2942	Gudha Khurd	SIKAR	Piprali	Outside Basin	Sub 4	Minor	27.569665	75.381786				0.29					119.00	
2909	Haripura	SIKAR	Piprali	Outside Basin	Sub 4	MINOR	27.541667	75.300000	6.00	615.00	34.98	0.96	0.36 sq. km	97.96cumec	1.77	348.00	343.00	275.00
2936	Nagal	SIKAR	Piprali	Outside Basin	Sub 4	Minor	27.553434	75.422135				0.94					162.00	
2930	Pharaswali Dhani	SIKAR	Piprali	Outside Basin	Sub 4	Minor	27.556049	75.341823	10.00	990.00	1.07	0.86	0.516 sq. km	185.06 cumec	4.14	289.00	345.00	183.00
	Sub Basin Total										**39.64**	**12.94**				**1,481.50**	**3,453.40**	**1,159.58**
1487	Bhiksingh Khadeen	BIKANER	Kolayat	Outside Basin	Sub 5	MINOR	27.583333	72.900000				0.06					7.00	
1516	Hadia Bund	BIKANER	Kolayat	Outside Basin	Sub 5	Minor	27.661418	72.863347				0.09					24.00	
1499	Gedoya Khadeen	BIKANER	Nokha	Outside Basin	Sub 5	MINOR	27.505292	73.079589				0.08					53.00	
1958	Ramdevra Anicut	JAISALMER	Sankra	Outside Basin	Sub 5	MINOR	27.007966	71.926625				0.80					23.20	
2193	Akhaghana Khadeen	JODHPUR	Bap	Outside Basin	Sub 5	MINOR	27.331578	72.171550				0.19					27.00	
2199	Badhaura Khadeen	JODHPUR	Bap	Outside Basin	Sub 5	MINOR	27.313850	72.293658				0.17					24.00	
2200	Badi Seer Khadeen II	JODHPUR	Bap	Outside Basin	Sub 5	MINOR	27.487103	72.452660				0.10					65.00	
2377	Badisid KhadeenI	JODHPUR	Bap	Outside Basin	Sub 5	Minor	27.489776	72.468224				0.20					125.00	
2212	Baowri Khurd Khadeen	JODHPUR	Bap	Outside Basin	Sub 5	MINOR	27.211319	72.271198				0.53					76.00	
2213	Bap Khadeen	JODHPUR	Bap	Outside Basin	Sub 5	MINOR	27.350329	72.396572				0.11					100.00	
2214	Bari Seer Khadeen I	JODHPUR	Bap	Outside Basin	Sub 5	MINOR	27.478579	72.451186				0.10					125.00	
2233	Bheem Zila Gaon	JODHPUR	Bap	Outside Basin	Sub 5	MINOR	27.374875	72.262060				0.06					45.00	
2388	Deganali Ki Dhani	JODHPUR	Bap	Outside Basin	Sub 5	Minor	27.336917	72.452349				0.11					15.00	
2258	Gadna Khadeen	JODHPUR	Bap	Outside Basin	Sub 5	MINOR	27.430928	72.374679				0.18					26.00	
2371	Ghantiyala Khadeen	JODHPUR	Bap	Outside Basin	Sub 5	Minor	27.359503	72.884851				0.10					21.00	
2266	Gotharli Khadeen	JODHPUR	Bap	Outside Basin	Sub 5	MINOR	27.216244	72.467186				0.17					24.00	
2281	Jemla Khadeen I	JODHPUR	Bap	Outside Basin	Sub 5	MINOR	27.217281	72.212283				0.15					21.00	
2283	Kanasar Khadeen	JODHPUR	Bap	Outside Basin	Sub 5	MINOR	27.439432	72.117967				0.18					25.00	
2284	Kansingh Ki Seed Khadeen	JODHPUR	Bap	Outside Basin	Sub 5	MINOR	27.516674	72.513578				0.08					79.00	
2292	Khakhuri Khadeen	JODHPUR	Bap	Outside Basin	Sub 5	MINOR	27.357584	72.112692				0.17					24.00	
2313	Manchitiya Khadeen	JODHPUR	Bap	Outside Basin	Sub 5	MINOR	27.465119	72.315815				2.09					299.00	
2324	Naya Gaon Khadeen	JODHPUR	Bap	Outside Basin	Sub 5	MINOR	27.457416	72.387504				0.30					43.00	
2328	Nokhra Anicut	JODHPUR	Bap	Outside Basin	Sub 5	MINOR	27.223147	72.935028				0.22					10.00	
2345	Raneri Khadeen	JODHPUR	Bap	Outside Basin	Sub 5	MINOR	27.312703	72.142617				0.13					55.00	
2348	Rawara Khadeen	JODHPUR	Bap	Outside Basin	Sub 5	MINOR	27.392209	72.168666				0.15					22.00	
2351	Saguri Khadeen	JODHPUR	Bap	Outside Basin	Sub 5	MINOR	27.290162	72.184525				0.42					60.00	
2354	Sekhasar Khadeen III	JODHPUR	Bap	Outside Basin	Sub 5	MINOR	27.285663	72.214322				0.20					28.00	
2361	Sutharon Ka Bera	JODHPUR	Bap	Outside Basin	Sub 5	MINOR	27.316041	72.979019				0.12					125.00	
2310	Maghwalon wala Gajsinghpura Anicut	JODHPUR	Bhopalgarh	Outside Basin	Sub 5	MINOR	26.832538	73.453945				0.07					10.35	
2227	Bhakhri Khadeen	JODHPUR	Osian	Outside Basin	Sub 5	MINOR	26.909788	72.605627				0.16					23.00	
2301	Ladu Ki Dhani Anicut	JODHPUR	Osian	Outside Basin	Sub 5	MINOR	26.997729	72.979483				0.11					87.00	
2333	Parasalasar	JODHPUR	Osian	Outside Basin	Sub 5	MINOR	26.866560	72.896995				0.78					112.00	
2376	Satawat Khadeen	JODHPUR	Osian	Outside Basin	Sub 5	Minor	26.974628	72.867867				0.10					70.13	
2194	Amla Khadeen	JODHPUR	Phalodi	Outside Basin	Sub 5	MINOR	27.103699	72.517293				0.07					87.88	
2201	Baigri Kal Khadeen	JODHPUR	Phalodi	Outside Basin	Sub 5	MINOR	27.130230	72.236775				0.10					55.00	
2379	Bawadi Barsinga Khadeen	JODHPUR	Phalodi	Outside Basin	Sub 5	Minor	27.073295	72.779076				0.54					77.00	
2370	Bhikji ka Baga Anicut	JODHPUR	Phalodi	Outside Basin	Sub 5	Minor	27.236949	72.774996				0.18					23.43	
2249	Chhitar Ka Bandh	JODHPUR	Phalodi	Outside Basin	Sub 5	MINOR	27.141991	72.818603				0.15					22.00	
2250	Dediya Khadeen	JODHPUR	Phalodi	Outside Basin	Sub 5	MINOR	26.865024	72.103816				0.40					56.60	
2255	Dhelana Khadeen	JODHPUR	Phalodi	Outside Basin	Sub 5	MINOR	26.939440	72.627008				0.08					93.00	
2264	Gol Jod Bandh	JODHPUR	Phalodi	Outside Basin	Sub 5	MINOR	26.987572	72.195015				2.80					297.00	
2277	Jalora Khadeen I	JODHPUR	Phalodi	Outside Basin	Sub 5	MINOR	26.978149	72.465508				0.46					65.00	
2278	Jalora Khadeen II	JODHPUR	Phalodi	Outside Basin	Sub 5	MINOR	26.975838	72.425810				0.46					66.00	
2285	Kerala Khadeen	JODHPUR	Phalodi	Outside Basin	Sub 5	MINOR	27.085684	72.824529				0.11					176.00	
2286	Kerla Bandh	JODHPUR	Phalodi	Outside Basin	Sub 5	MINOR	27.069631	72.830924				0.40					56.60	
2293	Kharia Anicut	JODHPUR	Phalodi	Outside Basin	Sub 5	MINOR	27.228413	73.015410				0.06					8.00	
2400	Kundal Bundh	JODHPUR	Phalodi	Outside Basin	Sub 5	Minor	27.115544	72.263240				0.17					176.00	
2401	Kurj Khadeen	JODHPUR	Phalodi	Outside Basin	Sub 5	Minor	27.025657	72.133868				0.11					20.00	
2306	Lordia Khadeen I	JODHPUR	Phalodi	Outside Basin	Sub 5	MINOR	27.047808	72.432270				0.14					89.00	
2308	Lordiya Khadeen II	JODHPUR	Phalodi	Outside Basin	Sub 5	MINOR	27.060664	72.397560				0.15					22.00	
2404	Maliyo ki Dhora Khadeen Phalodi	JODHPUR	Phalodi	Outside Basin	Sub 5	Minor	27.130109	72.347462				0.15					22.00	
2405	Maliyon ka Dhora Khadeen Kheechan	JODHPUR	Phalodi	Outside Basin	Sub 5	Minor	27.137567	72.418582				0.15					21.00	
2406	Meghwalo wala Anicut	JODHPUR	Phalodi	Outside Basin	Sub 5	Minor	27.007897	72.426738				0.12					17.00	
2350	Sadawata Khadeen	JODHPUR	Phalodi	Outside Basin	Sub 5	MINOR	27.129926	72.318716				0.10					70.13	

S. No.	Project Name	District	Block	Basin	Sub-basin	Class	Latitude (DD)	Longitude (DD)	Ht. above Lowest Foundation (m)	Length of Dam (m)	Gross Storage Capacity (Mm^3)	Live Storage Capacity (Mm^3)	Reservoir Area at FRL (km^2)	Design Spilway Capacity (cusecs)	Length of Canal System (km)	Command Area (ha)		
																GCA	CCA	ICA
1	2	3	4	5	6	7	9	10	11	12	13	14	15	16	17	18	19	20
2418	Thotha Balaji	JODHPUR	Phalodi	Outside Basin	Sub 5	Minor	27.141659	72.415892				0.07					65.00	
2489	Baliya Bund	NAGAUR	Didwana	Outside Basin	Sub 5	MINOR	27.352465	74.529639				0.22					41.10	
2534	Kharibali	NAGAUR	Didwana	Outside Basin	Sub 5	MINOR	27.156641	74.483730				0.18					37.84	
2560	Raghunathpura Bund	NAGAUR	Didwana	Outside Basin	Sub 5	MINOR	27.369634	74.510970				0.01					59.00	
2572	Badi Khatu	NAGAUR	Jayal	Outside Basin	Sub 5	Minor	27.121938	74.282465				0.14					108.46	
2494	Barnel Bund	NAGAUR	Jayal	Outside Basin	Sub 5	MINOR	27.195934	74.256616				0.06					268.00	
2508	Chajoli	NAGAUR	Jayal	Outside Basin	Sub 5	MINOR	27.168883	74.214555				0.08					7.85	
2514	Deadiyakallan Bund	NAGAUR	Jayal	Outside Basin	Sub 5	MINOR	27.125305	73.901862				0.54					256.93	
2520	Firojpura Bund	NAGAUR	Jayal	Outside Basin	Sub 5	MINOR	27.166068	74.318028				0.07					12.61	
2527	Janki Ghati Bund	NAGAUR	Jayal	Outside Basin	Sub 5	MINOR	27.232101	74.326546				0.77					58.18	
2531	Kanolarka Bas	NAGAUR	Jayal	Outside Basin	Sub 5	MINOR	27.104825	73.902659				0.25					28.00	
2533	Khanwar Bund	NAGAUR	Jayal	Outside Basin	Sub 5	MINOR	27.196158	73.957533				0.29					45.77	
2488	Badikhali bund	NAGAUR	Ladnu	Outside Basin	Sub 5	MINOR	27.329708	74.319824				0.14					43.89	
2552	Palada Bund	NAGAUR	Ladnu	Outside Basin	Sub 5	MINOR	27.531324	74.337242	7.50	810.00	0.22	0.73	-	56.06		65.00	33.67	56.00
2509	Chandi bund	NAGAUR	Makrana	Outside Basin	Sub 5	MINOR	27.203463	74.630654				0.02					165.00	
2526	Hillori Bund	NAGAUR	Mundwa	Outside Basin	Sub 5	MINOR	26.882254	73.699608				0.33					32.36	
2576	Khanolav	NAGAUR	Mundwa	Outside Basin	Sub 5	Minor	27.079866	73.634732				0.25					70.04	
2548	Morchadlan Modi	NAGAUR	Mundwa	Outside Basin	Sub 5	MINOR	26.995176	73.467127				0.12					59.72	
2563	Roon Bund	NAGAUR	Mundwa	Outside Basin	Sub 5	MINOR	26.849249	73.779552				0.13					32.38	
2568	Soliyana Bund	NAGAUR	Mundwa	Outside Basin	Sub 5	MINOR	27.052811	73.791218	4.26	2,606.04	0.62	0.54		113.20	-	254.96	61.52	58.28
2573	Bhanwal	NAGAUR	Nagaur	Outside Basin	Sub 5	Minor	27.205671	73.589402				0.18					44.52	
2569	Surjaniya was Bund	NAGAUR	Nagaur	Outside Basin	Sub 5	MINOR	27.217254	73.932434	9.60	750.00	0.37	0.18	0.53	58.59	1.86	159.00	28.00	65.00
	Sub Basin Total										**1.21**	**20.64**				**478.96**	**4,954.16**	**179.28**
818	Anta khadeen	BARMER	Barmer	Outside Basin	Sub 6	Minor	25.771515	71.091421	2.90	825.00	0.08	0.08	-	51.90	-	11.00	11.00	11.00
698	Bolla Khadeen	BARMER	Barmer	Outside Basin	Sub 6	MINOR	25.828857	71.224063	2.55	1,780.00	0.07	0.07	-	53.75	-	8.00	8.00	8.00
710	Derasar Khadeen I	BARMER	Barmer	Outside Basin	Sub 6	MINOR	25.785019	71.161345	3.18	911.00	0.11	0.11	-	87.80	-	23.54	23.54	23.54
711	Derasar Khadeen II	BARMER	Barmer	Outside Basin	Sub 6	MINOR	25.784022	71.157548	3.70	480.00	0.11	0.11	-	57.54	-	20.10	20.10	20.10
718	Dudaberi Khadeen	BARMER	Barmer	Outside Basin	Sub 6	MINOR	25.962872	71.038107	2.75	810.00	0.03	0.03	-	25.91	-	8.60	8.60	8.60
740	Jaydu Khadeen	BARMER	Barmer	Outside Basin	Sub 6	MINOR	25.833856	71.051653	1.80	310.00	0.06	0.06	-	34.24	-	17.00	17.00	17.00
750	Khadeen village Khadeen	BARMER	Barmer	Outside Basin	Sub 6	MINOR	25.666736	71.088463	3.30	186.00	0.08	0.08	-	16.97	-	10.00	10.00	10.00
753	Khetsingh ka Khadeen (Auta)	BARMER	Barmer	Outside Basin	Sub 6	MINOR	25.777895	71.109426	3.88	387.50	0.11	0.11	-	53.18	-	26.40	26.40	26.40
702	Charanowala Khadeen (Bhadresh)	BARMER	Sheo	Outside Basin	Sub 6	MINOR	25.891251	70.880225	2.45	660.00	0.08	0.08	-	65.09	-	6.20	6.20	6.20
703	Charnowala ka khadeen (Devri)	BARMER	Sheo	Outside Basin	Sub 6	MINOR	25.921715	70.878283	2.50	1,630.00	0.20	0.20	-	127.24	-	25.00	25.00	25.00
712	Detani Khadeen	BARMER	Sheo	Outside Basin	Sub 6	MINOR	25.821155	70.799280	1.80	915.00	0.05	0.05	-	86.98	-	11.00	11.00	11.00
719	Dudura Khadeen	BARMER	Sheo	Outside Basin	Sub 6	MINOR	26.047122	70.855809	2.50	435.00	0.07	0.07	-	72.89	-	20.60	20.60	20.60
724	Gordia Khadeen (Sanapa)	BARMER	Sheo	Outside Basin	Sub 6	MINOR	25.969092	70.853113	2.00	532.00	0.05	0.05	-	99.30	-	34.00	34.00	34.00
725	Gordia Khadeen (Sanapa)	BARMER	Sheo	Outside Basin	Sub 6	MINOR	25.972095	70.853664	2.70	975.00	0.23	0.23	-	14.71	-	63.82	63.82	63.82
728	Gurdia Khadeen	BARMER	Sheo	Outside Basin	Sub 6	MINOR	25.972249	70.851197	2.80	490.00	0.05	0.05	-	124.76	-	23.20	23.20	23.20
729	Harsani Khadeen II	BARMER	Sheo	Outside Basin	Sub 6	MINOR	25.975401	70.765675	2.50	1,010.00	0.13	0.13	-	1,135.00	-	36.15	36.15	36.15
742	Jhankli Khadeen	BARMER	Sheo	Outside Basin	Sub 6	MINOR	26.092055	70.884502	2.35	1,005.00	0.11	0.11	-	73.39	-	22.50	22.50	22.50
744	Judia Khadeen II	BARMER	Sheo	Outside Basin	Sub 6	MINOR	26.084901	70.845597	2.60	1,095.00	0.08	0.08	-	63.43	-	20.79	20.79	20.79
746	Kana ka Gaon I Khadeen	BARMER	Sheo	Outside Basin	Sub 6	MINOR	26.197378	71.059073	2.65	905.00	0.14	0.14	-	146.80	-	10.00	10.00	10.00
747	Kana ka Gaon II Khadeen	BARMER	Sheo	Outside Basin	Sub 6	MINOR	26.200000	71.050000	5.00	387.00	0.34	0.34	-	18.38	-	34.40	34.40	34.40
748	Kapasia Ki Beri Khadeen (Redana)	BARMER	Sheo	Outside Basin	Sub 6	MINOR	25.871606	70.999211			0.10	0.10					20.34	
751	Kharchi Khadeen	BARMER	Sheo	Outside Basin	Sub 6	MINOR	25.934564	70.833222	1.70	920.00	0.08	0.08	-	29.54	-	14.00	14.00	14.00
830	Meghwalo ka kn. (Judia)	BARMER	Sheo	Outside Basin	Sub 6	Minor	26.059146	70.861979	2.40	1,008.00	0.09	0.09	-	77.48	-	26.00	26.00	26.00
779	Phogera Khadeen	BARMER	Sheo	Outside Basin	Sub 6	MINOR	25.986879	70.979255	2.55	810.00	0.09	0.09	-	37.52	-	11.00	11.00	11.00
782	Poshma Khadeen	BARMER	Sheo	Outside Basin	Sub 6	MINOR	26.061209	70.966732	2.10	815.00	0.08	0.08	-	78.47	-	38.80	38.80	38.80
790	Redana Khadeen	BARMER	Sheo	Outside Basin	Sub 6	MINOR	25.863598	71.000794	2.60	825.00	0.06	0.06	-	74.50	-	13.00	13.00	13.00
	Sub Basin Total										**2.68**	**2.70**				**535.10**	**555.44**	**535.10**
	Basin Total										**44.20**	**37.74**				**2,610.56**	**9,087.00**	**1,958.96**
1748	Baripura	DHAULPUR	Bari	Parbati	Parbati	Minor	26.631071	77.717678	NA	1,900.00	0.65	0.65	NA	NA	Bed cultivation	117.40	111.34	100.00
1730	Chilla Chand	DHAULPUR	Bari	Parbati	Parbati	MINOR	26.591667	77.508333	NA	200.00	0.41	0.39	NA	NA	Bed cultivation	NA	80.90	40.50
1731	D.B.R. Jheel	DHAULPUR	Bari	Parbati	Parbati	MINOR	26.649139	77.663904	NA	1,600.00	2.83	2.26	NA	NA	2.00	131.50	121.10	60.70
1735	Hussinpura	DHAULPUR	Bari	Parbati	Parbati	MINOR	26.640971	77.680419	2.89	1,162.00	0.19	0.96	N.A	N.A	Not Canal	N.A	323.80	N.A
1738	Nadroli Bund	DHAULPUR	Bari	Parbati	Parbati	MINOR	26.600000	77.550000	NA	1,000.00	1.84	0.74	NA	NA	4.20	NA	323.80	121.00
1749	R.T.Bund	DHAULPUR	Bari	Parbati	Parbati	Minor	26.527117	77.595955	7.05	1,300.00	0.71	0.70	NA	NA	No canal	NA	323.80	161.94
1742	Retari ka Tal	DHAULPUR	Bari	Parbati	Parbati	MINOR	26.516232	77.608125				0.56					323.80	
1743	Roond Pura	DHAULPUR	Bari	Parbati	Parbati	MINOR	26.637900	77.555485				0.93					182.10	
1751	Shahpura	DHAULPUR	Bari	Parbati	Parbati	Minor	26.524953	77.594887	NA	550.00	1.93	1.94	NA	NA	2.40	108.90	78.94	72.00
1753	Sunipur	DHAULPUR	Bari	Parbati	Parbati	Minor	26.637963	77.555376	NA	500.00	0.14	0.14	NA	NA	Bed cultivation	26.30	24.29	16.20
1745	Talab Shahi	DHAULPUR	Bari	Parbati	Parbati	MINOR	26.621575	77.653199	NA	2,500.00	2.85	2.40	1.50	97.41	4.40	487.40	405.00	190.00
1746	Umreh Bund	DHAULPUR	Bari	Parbati	Parbati	MINOR	26.623611	77.550000	NA	1,300.00	2.12	1.70	NA	NA	4.29	344.12	323.80	161.94
1729	Bansrai Bund	DHAULPUR	Baseri	Parbati	Parbati	MINOR	26.681638	77.407430	NA	300.00	0.45	0.45	NA	NA	2.00	NA	81.00	40.50

S. No.	Project Name	District	Block	Basin	Sub-basin	Class	Latitude (DD)	Longitude (DD)	Ht. above Lowest Foundation (m)	Length of Dam (m)	Gross Storage Capacity (Mm^3)	Live Storage Capacity (Mm^3)	Reservoir Area at FRL (km^2)	Design Spilway Capacity (cusecs)	Length of Canal System (km)	Command Area (ha)		
																GCA	CCA	ICA
1	2	3	4	5	6	7	9	10	11	12	13	14	15	16	17	18	19	20
1744	Roti Pura	DHAULPUR	Baseri	Parbati	Parbati	MINOR	26.569121	77.443915				0.14					36.40	
1754	Tarba	DHAULPUR	Baseri	Parbati	Parbati	Minor	26.587386	77.469795	NA	920.00	0.34	0.34	NA	NA	Bed cultivation	78.10	70.44	44.50
1737	Megh Sagar	DHAULPUR	Dhaulpur	Parbati	Parbati	MINOR	26.668019	77.801031	NA	400.00	1.02	0.82	NA	NA	2.00	182.10	161.90	80.90
1739	Narpura Tank	DHAULPUR	Dhaulpur	Parbati	Parbati	MINOR	26.689833	77.821832	NA	1,300.00	0.85	0.81	NA	NA	1.50	48.56	40.50	20.20
1741	Ondela bund	DHAULPUR	Dhaulpur	Parbati	Parbati	MINOR	26.762500	77.850000				0.52					80.90	
1750	Rata Ki Khar	DHAULPUR	Dhaulpur	Parbati	Parbati	Minor	26.760989	77.831131	NA	1,830.00	0.76	0.76	NA	NA	Bed cultivation	NA	276.52	163.00
2443	Khuda	KARAULI	Karauli	Parbati	Parbati	MINOR	26.624046	77.329780				0.29					49.70	
2469	Ratiyapura	KARAULI	Karauli	Parbati	Parbati	Minor	26.512967	77.187305				0.14					35.00	
	Basin Total										**17.09**	**17.64**				**1,524.38**	**3,455.03**	**1,273.38**
438	Husepur Bund	ALWAR	Kishangarh Bas	Ruparail	Ruparail	MINOR	27.791316	76.837958				0.19					62.70	
445	Jajor Ka Naka	ALWAR	Kishangarh Bas	Ruparail	Ruparail	MINOR	27.700826	76.711569				0.55					109.30	
455	Karoli Ka Naka	ALWAR	Kishangarh Bas	Ruparail	Ruparail	MINOR	27.678361	76.674681				0.45					81.30	
458	Khanpur	ALWAR	Kishangarh Bas	Ruparail	Ruparail	MINOR	27.765258	76.793038	10.29	755.00	5.76	5.76	N.A		9,900.00	972.90	603.00	602.00
461	Kho-kh-Naka	ALWAR	Kishangarh Bas	Ruparail	Ruparail	MINOR	27.729279	76.738399				0.17					38.00	
497	Rata Khurd	ALWAR	Kishangarh Bas	Ruparail	Ruparail	MINOR	27.689419	76.689789	N.A	337.50	1.20	0.20	N.A	N.A	Not Canal	N.A	75.60	N.A
473	Milakpur Bund	ALWAR	Lachhmangarh	Ruparail	Ruparail	MINOR	27.550000	76.900000				0.85					39.00	
407	Bagola Bund	ALWAR	Rajgarh	Ruparail	Ruparail	MINOR	27.226287	76.631903	1.82	1,453.00	0.82	0.81	N.A	N.A	Not Canal	N.A	51.80	N.A
426	Dhamera Bund	ALWAR	Rajgarh	Ruparail	Ruparail	MINOR	27.272351	76.573026	3.35	1,170.43	4.80	4.33	N.A	79.30		892.67	636.70	637.10
428	Dholan	ALWAR	Rajgarh	Ruparail	Ruparail	MINOR	27.231007	76.529288				0.35					72.00	
464	Kothi Narainpur	ALWAR	Rajgarh	Ruparail	Ruparail	MINOR	27.275494	76.631596	2.43	504.00	0.50	0.50	N.A	N.A	Not Canal	N.A	40.00	N.A
488	Pratap Bund	ALWAR	Rajgarh	Ruparail	Ruparail	MINOR	27.223803	76.622076	3.99	547.50	0.25	0.26	N.A	N.A	Not Canal	N.A	23.10	N.A
514	Thekri Bund	ALWAR	Rajgarh	Ruparail	Ruparail	MINOR	27.212500	76.641667				0.21					38.00	
401	Ateria Bund	ALWAR	Ramgarh	Ruparail	Ruparail	MINOR	27.665932	76.821713				2.84					24.90	
436	Hans Sarowar	ALWAR	Ramgarh	Ruparail	Ruparail	MINOR	27.514379	76.747221	N.A	6,090.00	9.24	0.26	N.A	N.A	Not Canal	N.A	98.75	N.A
456	Karoli Ki Batai	ALWAR	Ramgarh	Ruparail	Ruparail	MINOR	27.633139	76.864776				0.17					38.00	
474	Nagla Banjir Bund	ALWAR	Ramgarh	Ruparail	Ruparail	MINOR	27.531454	76.748504	2.74	1,620.00	3.02	2.61	N.A	N.A	Not Canal	N.A	809.40	N.A
487	Piproli	ALWAR	Ramgarh	Ruparail	Ruparail	MINOR	27.550000	76.791667				0.90					1,864.40	
414	Bhindusi Bund	ALWAR	Tijara	Ruparail	Ruparail	MINOR	27.886623	76.800216				0.42					69.50	
417	Bilaspur Bund	ALWAR	Tijara	Ruparail	Ruparail	MINOR	27.888437	76.834084				1.18					65.90	
451	Jhiroli Bund	ALWAR	Tijara	Ruparail	Ruparail	MINOR	27.824090	76.857848	3.04	1,015.00	3.50	2.77	N.A	217.00	6,390.00	834.00	425.50	
476	Navgaon Khas Bund	ALWAR	Tijara	Ruparail	Ruparail	MINOR	27.884754	76.823320				0.17					46.60	
478	Navgaontek Bund	ALWAR	Tijara	Ruparail	Ruparail	MINOR	27.882424	76.813936				0.17					39.00	
479	Neemle Bund	ALWAR	Tijara	Ruparail	Ruparail	MINOR	27.853328	76.929286	5.48	897.00	0.62	0.62	N.A	N.A	Not Canal	N.A	39.00	N.A
409	Baleta Bund	ALWAR	Umren	Ruparail	Ruparail	MINOR	27.350642	76.548979	2.43	840.00	5.80	2.83	N.A	N.A	Not Canal	N.A	75.70	N.A
411	Bera Weir	ALWAR	Umren	Ruparail	Ruparail	MINOR	27.420387	76.508740				3.29					783.70	
489	Prem Ratnakar Bund	ALWAR	Umren	Ruparail	Ruparail	MINOR	27.490354	76.620027	4.57	7,200.00	1.11	1.10	N.A	N.A	Not Canal	N.A	33.20	N.A
507	Sileberi	ALWAR	Umren	Ruparail	Ruparail	MINOR	27.333295	76.547596	6.10	2,400.00	5.60	5.46	N.A	34.60		1,045.00	836.40	502.00
508	Siliserh	ALWAR	Umren	Ruparail	Ruparail	MINOR	27.517460	76.536285	12.00	305.00	13.93	12.23	N.A	NA	26,550.00	1,034.22	1,416.40	542.80
521	Training Bund	ALWAR	Umren	Ruparail	Ruparail	MINOR	27.638438	76.596981	6.40	3,960.00	2.38	0.14	N.A	N.A	Not Canal	N.A	57.00	N.A
523	Vijay Sagar	ALWAR	Umren	Ruparail	Ruparail	MINOR	27.604479	76.583733				1.64					359.80	
844	Ahu Bund	BHARATPUR	Deeg	Ruparail	Ruparail	MINOR	27.458014	77.351673	2.23	4,270.00	NA	1.14	2.40	-	Nil	340.00	340.00	340.00
1028	Chulahara bund	BHARATPUR	Deeg	Ruparail	Ruparail	Minor	27.558414	77.241691	3.96	0.76		0.14	NA	23.77	NA	NA	20.00	NA
888	Chulera	BHARATPUR	Deeg	Ruparail	Ruparail	MINOR	27.553536	77.238541				0.26					48.00	
924	Kakra	BHARATPUR	Deeg	Ruparail	Ruparail	MINOR	27.461250	77.188724	4.26	1.46	0.60	0.57	NA	22.81	NA	NA	160.00	NA
929	Karmuka	BHARATPUR	Deeg	Ruparail	Ruparail	MINOR	27.537848	77.230417				0.23					43.30	
937	Khera	BHARATPUR	Deeg	Ruparail	Ruparail	MINOR	27.564960	77.231726				0.28					40.00	
943	Kuchawati	BHARATPUR	Deeg	Ruparail	Ruparail	MINOR	27.448339	77.325786	2.99	4,330.00	2.40	2.35	5.28	896.00	Nil	769.00	769.00	769.00
971	Nigohi	BHARATPUR	Deeg	Ruparail	Ruparail	MINOR	27.521127	77.250467				0.43					135.00	
978	Panhori	BHARATPUR	Deeg	Ruparail	Ruparail	MINOR	27.445549	77.265574				0.33					42.00	
979	Paposa	BHARATPUR	Deeg	Ruparail	Ruparail	MINOR	27.566266	77.214911	3.81	3.90	0.80	0.85	NA	56.60	NA	NA	93.00	NA
1010	Shisam	BHARATPUR	Deeg	Ruparail	Ruparail	MINOR	27.493789	77.298213				2.10					270.00	
843	Agma Bund	BHARATPUR	Kaman	Ruparail	Ruparail	MINOR	27.650000	77.205556	2.43	3.35	NA	0.17	NA	53.77	NA	NA	41.00	NA
848	Alampur	BHARATPUR	Kaman	Ruparail	Ruparail	MINOR	27.694195	77.312375	2.80	5,700.00		0.43	2.40	750.00	Nil	489.00	330.64	489.00
850	Angrawali	BHARATPUR	Kaman	Ruparail	Ruparail	MINOR	27.673778	77.252396	4.87	0.30	NA	0.20	NA	93.39	NA	NA	32.00	NA
880	Bolkhera	BHARATPUR	Kaman	Ruparail	Ruparail	MINOR	27.663197	77.218254	3.96	0.45		0.20	NA	1.42	NA	NA	68.00	NA
890	Dehu Baroli	BHARATPUR	Kaman	Ruparail	Ruparail	MINOR	27.584910	77.216015				0.20					32.00	
900	Garh Ajan	BHARATPUR	Kaman	Ruparail	Ruparail	MINOR	27.684774	77.203347	4.10	0.33		0.13	NA	16.98	NA	NA	8.00	NA
911	Indroli	BHARATPUR	Kaman	Ruparail	Ruparail	MINOR	27.615266	77.264538	2.74	1.76	NA	0.14	NA	17.72	NA	NA	13.00	NA
1040	Kanawar bundly	BHARATPUR	Kaman	Ruparail	Ruparail	Minor	27.775224	77.089795				0.17					48.58	
1035	Nthwara bundh	BHARATPUR	Kaman	Ruparail	Ruparail	Minor	27.715734	77.240768	N.A	N.A	0.20	3.16	N.A	N.A	Not Canal	N.A	452.00	N.A
980	Papra	BHARATPUR	Kaman	Ruparail	Ruparail	MINOR	27.681827	77.001931	6.70	1,280.00	0.30	0.33	1.28	800.00	Nil	777.00	777.00	777.00
992	Sabalgarh	BHARATPUR	Kaman	Ruparail	Ruparail	MINOR	27.754565	77.213378				2.27					1,243.00	
993	Sablana	BHARATPUR	Kaman	Ruparail	Ruparail	MINOR	27.589779	77.265066	4.87	1.00	NA	0.23	NA	50.09	NA	NA	26.00	NA
878	Biyari	BHARATPUR	Pahari	Ruparail	Ruparail	MINOR	27.529102	77.136294	2.89	5.06		0.20	NA	15.28	NA	NA	1,305.00	NA
884	Budli	BHARATPUR	Pahari	Ruparail	Ruparail	MINOR	27.595407	76.994362	3.29	1.06		0.22	NA	2.83	NA	NA	42.00	NA

S. No.	Project Name	District	Block	Basin	Sub-basin	Class	Latitude (DD)	Longitude (DD)	Ht. above Lowest Foundation (m)	Length of Dam (m)	Gross Storage Capacity (Mm^3)	Live Storage Capacity (Mm^3)	Reservoir Area at FRL (km^2)	Design Spilway Capacity (cusecs)	Length of Canal System (km)	Command Area (ha)		
																GCA	CCA	ICA
1	2	3	4	5	6	7	9	10	11	12	13	14	15	16	17	18	19	20
889	Dabak	BHARATPUR	Pahari	Ruparail	Ruparail	MINOR	27.566552	77.114061	2.51	1,650.00	0.20	0.20	-	700.00	Nil	395.00	159.00	395.00
896	Dehri	BHARATPUR	Pahari	Ruparail	Ruparail	MINOR	27.500390	77.104864	2.13	3.68	NA	0.28	NA	9.62	NA	NA	418.00	NA
897	Derawana	BHARATPUR	Pahari	Ruparail	Ruparail	MINOR	27.584722	77.083333				0.14					379.00	
923	Kaithwara	BHARATPUR	Pahari	Ruparail	Ruparail	MINOR	27.599733	77.120690	3.11	4,170.00	0.30	0.28	3.28	392.00	Nil	432.00	755.00	432.00
946	Kurkain	BHARATPUR	Pahari	Ruparail	Ruparail	MINOR	27.487851	77.137429	2.96	5.57	0.20	0.20	NA	9.62	NA	NA	65.00	NA
982	Pathroli	BHARATPUR	Pahari	Ruparail	Ruparail	MINOR	27.650687	77.116588	3.04	5.46	0.30	0.34	NA	17.02	NA	NA	162.00	NA
984	Raff Bund	BHARATPUR	Pahari	Ruparail	Ruparail	MINOR	27.632877	77.152985	2.44	3,170.00	0.30	0.28	0.64	400.00	Nil	432.00	432.00	432.00
1002	Satwari	BHARATPUR	Pahari	Ruparail	Ruparail	MINOR	27.650727	77.136622	2.89	3.20	0.40	0.37	NA	NA	NA	NA	243.00	NA
	Basin Total										**64.53**	**72.25**				**8,412.79**	**17,945.17**	**5,917.90**
3194	Baxa ka Naka	UDAIPUR	Kotra	Sabarmati	Sabarmati	MINOR	24.273190	73.163391				1.98					348.00	
3221	Gamani Ka Naka	UDAIPUR	Kotra	Sabarmati	Sabarmati	MINOR	24.500820	73.134891				0.45					87.00	
3233	Hakawa	UDAIPUR	Kotra	Sabarmati	Sabarmati	MINOR	24.200016	73.128433				0.87					145.00	
3331	Har ka Naka	UDAIPUR	Kotra	Sabarmati	Sabarmati	Minor	24.551192	73.230884				1.35					246.00	
3238	Imli ka naka	UDAIPUR	Kotra	Sabarmati	Sabarmati	MINOR	24.252279	73.144006				1.96					281.00	
3240	Janiwas	UDAIPUR	Kotra	Sabarmati	Sabarmati	MINOR	24.126672	73.184452				0.51					93.00	
3262	Kyara	UDAIPUR	Kotra	Sabarmati	Sabarmati	MINOR	24.521089	73.161254				0.45					83.00	
3306	Sawan Kyara	UDAIPUR	Kotra	Sabarmati	Sabarmati	MINOR	24.225093	73.138600				0.65					131.00	
	Sub Basin Total										-	**8.22**				-	**1,414.00**	-
3195	Bhaga	UDAIPUR	Kotra	Sabarmati	Sei	MINOR	24.521017	73.042255				1.13					217.00	
3211	Chhapriya	UDAIPUR	Kotra	Sabarmati	Sei	MINOR	24.553221	73.148257				0.45					88.00	
3246	Kalibore	UDAIPUR	Kotra	Sabarmati	Sei	MINOR	24.701635	73.206661				6.94					518.00	
3263	Kyari	UDAIPUR	Kotra	Sabarmati	Sei	MINOR	24.695052	73.173380				1.23					246.00	
3277	Mandwa	UDAIPUR	Kotra	Sabarmati	Sei	MINOR	24.537269	73.110436				0.62					114.00	
3299	Rohini	UDAIPUR	Kotra	Sabarmati	Sei	MINOR	24.566373	73.087359				1.70					276.00	
3300	Rupni	UDAIPUR	Kotra	Sabarmati	Sei	MINOR	24.549510	73.136684				0.71					174.00	
3307	Sei pick up weir	UDAIPUR	Kotra	Sabarmati	Sei	MINOR	24.552987	73.093023				3.26					466.00	
3328	Zed	UDAIPUR	Kotra	Sabarmati	Sei	MINOR	24.536111	73.083333				0.40					61.00	
	Sub Basin Total										-	**16.45**				-	**2,160.00**	-
1758	Ankar Solka Naka	DUNGARPUR	Bichhiwara	Sabarmati	Vatrak	MINOR	23.619444	73.688889	18.62	23.79	3.72	4.26	1.56	7.37	10.69	998.00	780.00	468.00
1761	Balari Ka Naka	DUNGARPUR	Bichhiwara	Sabarmati	Vatrak	MINOR	23.615976	73.692865	12.49	505.00	0.46	0.41	12.40	45.00	1.49	67.00	62.00	47.00
1771	Bilpan	DUNGARPUR	Bichhiwara	Sabarmati	Vatrak	MINOR	23.649753	73.741382	16.35	240.80	2.89	2.67	0.45	3.33	4.71	257.00	223.00	201.00
1780	Gajpur	DUNGARPUR	Bichhiwara	Sabarmati	Vatrak	MINOR	23.647839	73.765609	17.00	13.20	3.05	3.98	1.54	8.03	11.64	465.00	771.00	780.00
1794	Juda	DUNGARPUR	Bichhiwara	Sabarmati	Vatrak	MINOR	23.683333	73.650000	14.51	164.00	0.45	0.40	12.80	13.00	4.50	71.00	64.00	46.00
1844	Kaliyadara	DUNGARPUR	Bichhiwara	Sabarmati	Vatrak	Minor	23.604873	73.714327				0.48					75.00	
1796	Kankri Sel Ka Naka	DUNGARPUR	Bichhiwara	Sabarmati	Vatrak	MINOR	23.673527	73.688360				1.95					253.00	
1799	Karawara	DUNGARPUR	Bichhiwara	Sabarmati	Vatrak	MINOR	23.630131	73.741737				0.31					321.00	
1813	Mewara	DUNGARPUR	Bichhiwara	Sabarmati	Vatrak	MINOR	23.711399	73.545860	24.65	595.00	9.40	7.32	2.24	17.09	20.20	1,399.00	1,122.00	1,169.00
1776	Dhambola	DUNGARPUR	Simalwara	Sabarmati	Vatrak	MINOR	23.594329	73.766768	7.80	465.00	0.60	0.39	5.60	34.00	2.13	32.00	28.00	14.00
1808	Mandli	DUNGARPUR	Simalwara	Sabarmati	Vatrak	MINOR	23.546344	73.652188	10.71	192.00	0.31	0.28	10.80	67.00	2.10	80.00	54.00	32.00
1828	Sithal	DUNGARPUR	Simalwara	Sabarmati	Vatrak	MINOR	23.545813	73.702773	5.50	580.00	0.80	0.67	0.15	7.73	2.20	110.40	77.00	62.00
1835	Vatrak	DUNGARPUR	Simalwara	Sabarmati	Vatrak	MINOR	23.583519	73.735831	14.38	1,459.00	4.84	4.30	1.12	16.05	16.50	1,531.00	556.00	465.00
	Sub Basin Total										**26.51**	**27.42**				**5,010.40**	**4,386.00**	**3,284.00**
3217	Dewas Stage-I	UDAIPUR	Girwa	Sabarmati	Wakal	MINOR	24.467817	73.561273				3.43					490.49	
3196	Bhardodi	UDAIPUR	Gogunda	Sabarmati	Wakal	MINOR	24.695747	73.496573				0.62					81.00	
3332	Rantho ka naka	UDAIPUR	Gogunda	Sabarmati	Wakal	Minor	24.620556	73.524710				3.14					351.00	
3314	Sukher ka Naka	UDAIPUR	Gogunda	Sabarmati	Wakal	MINOR	24.652119	73.523050				2.52					486.00	
3202	Bhuj Ka naka	UDAIPUR	Jhadol	Sabarmati	Wakal	MINOR	24.325000	73.547222				1.84					332.00	
3226	Gopa Mata	UDAIPUR	Jhadol	Sabarmati	Wakal	MINOR	24.318933	73.394917				0.48					97.00	
3239	Jada Pipla	UDAIPUR	Jhadol	Sabarmati	Wakal	MINOR	24.366196	73.346699				0.62					129.00	
3241	Javli Ka Naka	UDAIPUR	Jhadol	Sabarmati	Wakal	MINOR	24.341093	73.396726				0.85					174.00	
3242	Jhadol	UDAIPUR	Jhadol	Sabarmati	Wakal	MINOR	24.404428	73.483802				2.49					750.00	
3247	Kantharia	UDAIPUR	Jhadol	Sabarmati	Wakal	MINOR	24.314700	73.477185				2.26					410.00	
3260	Koliyari	UDAIPUR	Jhadol	Sabarmati	Wakal	MINOR	24.329911	73.384179				0.56					136.00	
3267	Logri Mata	UDAIPUR	Jhadol	Sabarmati	Wakal	MINOR	24.388393	73.331433				0.31					89.00	
3276	Manas	UDAIPUR	Jhadol	Sabarmati	Wakal	MINOR	24.306484	73.525617				0.85					98.00	
3280	Mohamad phalasia	UDAIPUR	Jhadol	Sabarmati	Wakal	MINOR	24.437261	73.471040				1.01					200.00	
3282	Nagmala	UDAIPUR	Jhadol	Sabarmati	Wakal	MINOR	24.231222	73.369362				2.21					254.00	
3283	Nal	UDAIPUR	Jhadol	Sabarmati	Wakal	MINOR	24.447638	73.462702				0.14					29.00	
3288	Ogna	UDAIPUR	Jhadol	Sabarmati	Wakal	MINOR	24.521513	73.339012				7.00					1,250.00	
3319	Tindol ka naka	UDAIPUR	Jhadol	Sabarmati	Wakal	MINOR	24.327407	73.542797				0.62					142.00	
3326	Velnia	UDAIPUR	Jhadol	Sabarmati	Wakal	MINOR	24.428187	73.471811				0.14					41.00	
3199	Bhenta ka Naka	UDAIPUR	Kotra	Sabarmati	Wakal	MINOR	24.513077	73.240564				0.74					146.00	
3228	Goria	UDAIPUR	Kotra	Sabarmati	Wakal	MINOR	24.531907	73.244181				1.07					121.00	
3244	Jogiwada	UDAIPUR	Kotra	Sabarmati	Wakal	MINOR	24.436042	73.215374				6.30					1,000.00	
3308	Sei storage Diverson	UDAIPUR	Kotra	Sabarmati	Wakal	MINOR	24.383333	73.185556				25.45					-	
3323	Vas madra	UDAIPUR	Kotra	Sabarmati	Wakal	MINOR	24.600594	73.377790				1.33					93.00	
	Sub Basin Total										-	**65.98**				-	**2,793.00**	-

S. No.	Project Name	District	Block	Basin	Sub-basin	Class	Latitude (DD)	Longitude (DD)	Ht. above Lowest Foundation (m)	Length of Dam (m)	Gross Storage Capacity (Mm^3)	Live Storage Capacity (Mm^3)	Reservoir Area at FRL (km^2)	Design Spilway Capacity (cusecs)	Length of Canal System (km)	Command Area (ha)		
																GCA	CCA	ICA
1	2	3	4	5	6	7	9	10	11	12	13	14	15	16	17	18	19	20
	Basin Total										**26.51**	**118.06**				**5,010.40**	**10,753.00**	**3,284.00**
396	Ahir Majara Bund	ALWAR	Bansur	Sabi	Sabi	MINOR	27.788474	76.432780				0.23					40.60	
402	Babria	ALWAR	Bansur	Sabi	Sabi	MINOR	27.779929	76.380552	3.00	2,550.00	5.55	5.29	N.A		11,658.00	2,936.00	1,614.00	1,432.00
526	Dhakwasan	ALWAR	Bansur	Sabi	Sabi	Minor	27.728497	76.489318				0.39					138.00	
435	Hamirpur	ALWAR	Bansur	Sabi	Sabi	MINOR	27.718056	76.455556	N.A	98.00	0.20	0.17	N.A	N.A	2,100.00	N.A	36.00	N.A
524	Harsora Bund	ALWAR	Bansur	Sabi	Sabi	Minor	27.804971	76.466836	12.95		8.80	7.81	N.A		4,800.00	2,589.00	1,821.00	1,499.00
397	Almadika Bund	ALWAR	Kishangarh Bas	Sabi	Sabi	MINOR	27.864418	76.717685	2.13	2,460.00	0.34	0.34	N.A	225.40	Not Canal	N.A	83.40	N.A
403	Baduk	ALWAR	Kishangarh Bas	Sabi	Sabi	MINOR	27.753732	76.707917				1.19					243.00	
406	Baghor Bund	ALWAR	Kishangarh Bas	Sabi	Sabi	MINOR	27.765794	76.706121				0.18					51.80	
408	Bakathala	ALWAR	Kishangarh Bas	Sabi	Sabi	MINOR	27.858333	76.758333	2.74	942.00	0.25	0.30	N.A	110.40	Not Canal	N.A	57.00	N.A
412	Bhageri Kalan	ALWAR	Kishangarh Bas	Sabi	Sabi	MINOR	27.904347	76.689089	2.74	1,339.80	0.28	0.28	N.A	293.10	Not Canal	N.A	28.70	N.A
440	Inchaka Bund	ALWAR	Kishangarh Bas	Sabi	Sabi	MINOR	27.781326	76.703788	3.00	1,500.00	0.91	0.90	N.A	169.90	Not Canal	N.A	21.40	N.A
441	Isapur Bund	ALWAR	Kishangarh Bas	Sabi	Sabi	MINOR	27.830307	76.692303	2.81	1,380.00	0.15	0.43	N.A	126.80	Not Canal	N.A	39.30	N.A
442	Ismailpur Bund	ALWAR	Kishangarh Bas	Sabi	Sabi	MINOR	27.765603	76.682283				0.93					94.30	
447	Jatka Bund	ALWAR	Kishangarh Bas	Sabi	Sabi	MINOR	27.846731	76.720832	2.43	2,490.00	2.08	2.08	N.A	537.50	Not Canal	N.A	166.70	N.A
470	Machroli Bund	ALWAR	Kishangarh Bas	Sabi	Sabi	MINOR	27.880022	76.696043				0.76					31.20	
520	Tohari Bund	ALWAR	Kishangarh Bas	Sabi	Sabi	MINOR	27.846206	76.692800	N.A	1,677.00	0.76	0.76	N.A	110.50	Not Canal	N.A	38.00	N.A
413	Bhageri Khurd	ALWAR	Kotkasim	Sabi	Sabi	MINOR	27.892524	76.666909	N.A		3.53	3.54	N.A	888.70			316.00	
457	Karwar Bund	ALWAR	Kotkasim	Sabi	Sabi	MINOR	27.941500	76.741255	2.43	2,490.00	2.08	2.08	N.A	53.70	Not Canal	N.A	263.90	N.A
463	Kot Kasim Bund	ALWAR	Kotkasim	Sabi	Sabi	MINOR	28.017761	76.702479				0.59					40.50	
410	Behroz Bund	ALWAR	Mandawar	Sabi	Sabi	MINOR	27.725283	76.545794				1.35					89.00	
419	Birtoli	ALWAR	Mandawar	Sabi	Sabi	MINOR	27.747323	76.598134	3.75	620.00	0.58	0.58	N.A		1,080.00	225.00	176.00	176.40
462	Kirt Singhpur	ALWAR	Mandawar	Sabi	Sabi	MINOR	27.907974	76.400405	6.00	2,541.00	0.14	0.37	N.A	N.A	Not Canal	N.A	52.60	N.A
528	Jhankari	ALWAR	Thanagazi	Sabi	Sabi	Minor	27.364107	76.242885		102.00	0.05	0.18	N.A	N.A	Not Canal	N.A	25.00	N.A
496	Rampur Bund	ALWAR	Thanagazi	Sabi	Sabi	MINOR	27.464404	76.290669	4.38	2,200.00	7.40	6.12	N.A	283.20	5,300.00	1,170.51	1,052.00	810.04
404	Baghor Bund	ALWAR	Tijara	Sabi	Sabi	MINOR	27.886679	76.908552				0.19					38.00	
415	Bhiwari	ALWAR	Tijara	Sabi	Sabi	MINOR	28.194847	76.838976				0.25					57.00	
420	Chawandi Kala Bund	ALWAR	Tijara	Sabi	Sabi	MINOR	28.026363	76.842786	2.13	2,130.00	0.26	0.26	N.A	N.A	Not Canal	N.A	60.70	N.A
427	Dhiriawas bund	ALWAR	Tijara	Sabi	Sabi	MINOR	28.090598	76.805944	3.00	1,650.00	0.85	0.64	N.A	N.A	Not Canal	N.A	91.90	N.A
434	Hamira Ka Bund	ALWAR	Tijara	Sabi	Sabi	MINOR	27.978316	76.863748				0.45					29.30	
439	Imlaki Bund	ALWAR	Tijara	Sabi	Sabi	MINOR	28.182152	76.886728	2.13	1,650.00	0.42	0.30	N.A	80.10	Not Canal	N.A	30.40	N.A
443	Isorda Bund	ALWAR	Tijara	Sabi	Sabi	MINOR	27.994295	76.796102	3.96	3,060.00	0.42	0.42	N.A	109.20	Not Canal	N.A	104.80	N.A
452	Jhiwana	ALWAR	Tijara	Sabi	Sabi	MINOR	28.143006	76.841392	6.00	1,200.00	1.53	1.53	N.A	162.90	Not Canal	N.A	126.60	N.A
453	Kaliyaki Bund	ALWAR	Tijara	Sabi	Sabi	MINOR	27.926004	76.900137	6.78	720.00	2.16	2.16	N.A	344.70	Not Canal	N.A	30.90	N.A
459	Khedar ur Bund	ALWAR	Tijara	Sabi	Sabi	MINOR	28.027233	76.893671	2.74	825.00	1.09	0.96	N.A	132.10	Not Canal	N.A	303.40	N.A
475	Nakhnol Bund	ALWAR	Tijara	Sabi	Sabi	MINOR	28.110311	76.848214	N.A	3,330.00	0.16	0.16	N.A	47.60	Not Canal	N.A	102.80	N.A
477	Navgaon Masit Bund	ALWAR	Tijara	Sabi	Sabi	MINOR	28.080181	76.827346				0.34					40.60	
480	Nimbaheri	ALWAR	Tijara	Sabi	Sabi	MINOR	28.081482	76.862062	6.00	2,652.00	1.24	1.24	N.A		3,292.00	510.00	458.90	368.40
483	Patan Malikpura	ALWAR	Tijara	Sabi	Sabi	MINOR	28.057498	76.885875	N.A	156.71		1.19	N.A	N.A	Not Canal	N.A	195.50	N.A
491	Qaziwala Bund	ALWAR	Tijara	Sabi	Sabi	MINOR	27.919202	76.867507				1.50					39.00	
494	Rambas	ALWAR	Tijara	Sabi	Sabi	MINOR	27.973318	76.836659	3.35	2,370.00	0.43	0.43	N.A	N.A	Not Canal	N.A	57.10	N.A
504	Saran Khurd	ALWAR	Tijara	Sabi	Sabi	MINOR	28.140489	76.944089	3.65	2,310.00	4.64	1.55	N.A		7,393.00	955.00	914.00	510.00
505	Shahidpur Barka	ALWAR	Tijara	Sabi	Sabi	MINOR	27.923251	76.843354				0.45					52.20	
506	Sharod Bund	ALWAR	Tijara	Sabi	Sabi	MINOR	28.195371	76.885479				0.42					49.30	
525	Teliwala Bagh Singh	ALWAR	Tijara	Sabi	Sabi	Minor	27.915310	76.782110				1.21					228.00	
517	Tijara (Kaliyaki)	ALWAR	Tijara	Sabi	Sabi	MINOR	27.913845	76.882939				1.63					304.00	
1851	Baneri	JAIPUR	Kotputli	Sabi	Sabi	MINOR	27.629486	76.026710	16.40		5.00	4.70		977.00		2,170.44	1,619.10	1,131.00
1854	Beri	JAIPUR	Kotputli	Sabi	Sabi	MINOR	27.677778	76.050000				0.91					97.00	
1872	Dantil Ka Naka	JAIPUR	Kotputli	Sabi	Sabi	MINOR	27.658416	75.994837				0.50					95.00	
1955	Badi Jodi	JAIPUR	Shahpura	Sabi	Sabi	Minor	27.450313	75.921936				13.25					50.00	
1874	Dewan	JAIPUR	Shahpura	Sabi	Sabi	MINOR	27.384958	76.021257				0.35					66.50	
1929	Raghunath Pura	JAIPUR	Shahpura	Sabi	Sabi	MINOR	27.433262	75.894613				0.40					66.50	
1946	Sikargatta	JAIPUR	Shahpura	Sabi	Sabi	MINOR	27.375000	76.038889	12.00		3.73	0.87		104.50		229.50	195.09	161.66
1848	Bairath	JAIPUR	Viratnagar	Sabi	Sabi	MINOR	27.419142	76.192697				1.20					176.00	
1855	Bhabhru	JAIPUR	Viratnagar	Sabi	Sabi	MINOR	27.453628	76.041750				0.86					259.10	
1856	Bhagawas	JAIPUR	Viratnagar	Sabi	Sabi	MINOR	27.408333	76.050000				0.45					95.00	
1879	Dhulkot	JAIPUR	Viratnagar	Sabi	Sabi	MINOR	27.464347	76.075776	8.40		1.02	1.02		271.00		213.00	197.00	197.00
1893	Jagaji	JAIPUR	Viratnagar	Sabi	Sabi	MINOR	27.414011	76.082901				0.23					38.00	
1896	Jawanpuradhabai	JAIPUR	Viratnagar	Sabi	Sabi	MINOR	27.476463	75.992082				2.50					596.26	
1921	Neemli	JAIPUR	Viratnagar	Sabi	Sabi	MINOR	27.525000	76.025000				0.20					54.30	
1922	Neezer	JAIPUR	Viratnagar	Sabi	Sabi	MINOR	27.455286	75.999904	7.55		0.75	0.72		104.31		250.00	205.00	205.00
1924	Panchudola	JAIPUR	Viratnagar	Sabi	Sabi	MINOR	27.518602	76.205438				0.65					97.10	
1938	Rampura Antela	JAIPUR	Viratnagar	Sabi	Sabi	MINOR	27.510506	76.026535				0.40					66.50	
2907	Hardas Ka Bass	SIKAR	Khandela	Sabi	Sabi	MINOR	27.499099	75.861066	6.10	229.00	0.52	0.45	0.24	101.88	1.22	142.00	76.90	65.00
2908	Hardas Ka Bass II	SIKAR	Khandela	Sabi	Sabi	MINOR	27.504095	75.852256	7.00	570.00	1.53	1.35	NA	228.30	3.24	246.00	246.20	219.00
2898	Chiplata	SIKAR	Neem Ka Thana	Sabi	Sabi	MINOR	27.580920	75.828398				0.82					180.65	
2901	Deepawas	SIKAR	Neem Ka Thana	Sabi	Sabi	MINOR	27.615239	75.883921	6.00	310.00	1.09	0.89	0.53	174.32	4.32	222.00	183.30	132.00

S. No.	Project Name	District	Block	Basin	Sub-basin	Class	Latitude (DD)	Longitude (DD)	Ht. above Lowest Foundation (m)	Length of Dam (m)	Gross Storage Capacity (Mm^3)	Live Storage Capacity (Mm^3)	Reservoir Area at FRL (km^2)	Design Spilway Capacity (cusecs)	Length of Canal System (km)	Command Area (ha)		
																GCA	CCA	ICA
1	2	3	4	5	6	7	9	10	11	12	13	14	15	16	17	18	19	20
2910	Heerwala	SIKAR	Neem Ka Thana	Sabi	Sabi	MINOR	27.597790	75.858096	6.70	240.00	0.32	0.32	0.18	47.60	2.85	132.00	81.00	46.00
2918	Khirdti	SIKAR	Neem Ka Thana	Sabi	Sabi	MINOR	27.523145	75.884644	5.00	640.00	0.38	0.31	0.19	55.46		127.00	109.00	87.00
2924	Raipur Jagir	SIKAR	Neem Ka Thana	Sabi	Sabi	MINOR	27.480139	75.906226	6.70	180.00	0.28	0.25	NA	40.18	0.88	53.00	44.00	32.00
2926	Sagar Ki Mori	SIKAR	Neem Ka Thana	Sabi	Sabi	MINOR	27.560765	75.849598	6.10	120.00	0.41	0.20	0.24	30.07	1.52	96.00	43.70	57.00
	Basin Total										**61.33**	**87.92**				**12,266.45**	**14,772.00**	**7,128.50**
399	Anandpur	ALWAR	Neemrana	Shekhawati	Dohan	MINOR	28.110389	76.367117				0.17					60.00	
465	Kutina	ALWAR	Neemrana	Shekhawati	Dohan	MINOR	28.062624	76.443628				0.31					108.00	
509	Siryani Bund	ALWAR	Neemrana	Shekhawati	Dohan	MINOR	28.038839	76.423364				0.85					38.10	
2171	Ajit Sagar	JHUNJHUNUN	Khetri	Shekhawati	Dohan	MINOR	27.991508	75.856084	21.15	210.00	4.63	4.61	1.86 sq. km	461.40 cumec	5.30	739.00	662.00	662.00
2172	Bansial	JHUNJHUNUN	Khetri	Shekhawati	Dohan	MINOR	27.973579	75.852352	6.70	340.00	0.57	0.50	NA	101.94	2.19	97.00	81.00	72.00
2173	Dadafateh Pura	JHUNJHUNUN	Khetri	Shekhawati	Dohan	MINOR	28.007757	75.876411	7.01	254.00	0.23	0.20	NA	45.87	2.40	97.00	43.00	58.00
2174	Dogar Nallah	JHUNJHUNUN	Khetri	Shekhawati	Dohan	MINOR	27.928276	75.771915	12.54	80.00	0.58	0.52	0.14	98.54	1.74	292.00	265.00	150.00
2175	Doharwala	JHUNJHUNUN	Khetri	Shekhawati	Dohan	MINOR	27.899905	75.832169	3.84	1,000.00	1.09	1.00	0.60	NA	3.78	302.00	240.00	143.00
2177	Kala Bhuja	JHUNJHUNUN	Khetri	Shekhawati	Dohan	MINOR	27.970833	75.800000	11.97	120.00	0.76	0.76	NA	NA	0.91	121.00	121.00	81.00
2191	Laxmanpura	JHUNJHUNUN	Khetri	Shekhawati	Dohan	Minor	27.859866	75.791571				0.26					188.00	
2192	Modi llakhar	JHUNJHUNUN	Khetri	Shekhawati	Dohan	Minor	28.000421	75.947561	14.60	2,830.00	5.70	4.54	3.00 sq. km	793.64cumec	9.87	1,243.00	1,070.00	649.00
2185	Ramwa	JHUNJHUNUN	Khetri	Shekhawati	Dohan	MINOR	28.068924	75.924830	3.64	1,280.00	1.55	1.21	0.647 sq. km	126.78 cumec	3.05	462.00	426.00	277.00
2187	Thikari a Ki Dhani	JHUNJHUNUN	Khetri	Shekhawati	Dohan	MINOR	27.905574	75.875207	4.42	370.00	0.50	0.37	NA	46.72	0.90	74.00	65.00	93.00
2188	Tonda	JHUNJHUNUN	Khetri	Shekhawati	Dohan	MINOR	27.963977	75.885515	10.31	640.00	0.76	0.68	NA	104.46	2.13	190.00	188.00	113.00
2894	Baran	SIKAR	Neem Ka Thana	Shekhawati	Dohan	MINOR	27.739711	76.011071	7.00	370.00	0.40	0.39	0.28	48.39	1.50	91.00	73.00	57.00
2902	Dokan	SIKAR	Neem Ka Thana	Shekhawati	Dohan	MINOR	27.785244	75.906774	8.50	540.00	0.63	0.55	0.21	40.75	2.50	178.00	127.00	80.00
2904	Fatehpura	SIKAR	Neem Ka Thana	Shekhawati	Dohan	MINOR	27.793274	76.041187	610.00	1,200.00	1.47	1.33	0.46	130.18	2.89	290.00	266.00	292.00
2911	Jeelo	SIKAR	Neem Ka Thana	Shekhawati	Dohan	MINOR	27.841529	75.901465	9.10	350.00	0.52	0.47	NA	53.23	3.75	111.00	85.00	68.00
2912	Jhalra	SIKAR	Neem Ka Thana	Shekhawati	Dohan	MINOR	27.849793	75.886579	7.90	180.00	0.26	0.22	0.03	47.83	1.21	79.00	70.85	51.00
2913	Kala Ki Nangal	SIKAR	Neem Ka Thana	Shekhawati	Dohan	MINOR	27.744631	75.959459				0.41					93.00	
2919	Lower Rella	SIKAR	Neem Ka Thana	Shekhawati	Dohan	MINOR	27.683721	75.933140	7.80	2,130.00	1.20	0.70	NA	53.70	4.27	268.00	244.00	243.00
2920	Makari	SIKAR	Neem Ka Thana	Shekhawati	Dohan	MINOR	27.784538	75.818644				1.10					142.00	
2922	Paran	SIKAR	Neem Ka Thana	Shekhawati	Dohan	MINOR	27.840051	75.826570	6.20	1,050.00	0.56	0.51	0.24	106.40	3.00	117.00	135.00	74.00
2927	Shampur	SIKAR	Neem Ka Thana	Shekhawati	Dohan	MINOR	27.849090	75.945232				2.38					271.00	
2943	Sikargarh	SIKAR	Neem Ka Thana	Shekhawati	Dohan	Minor	27.789237	75.943844	8.00	370.00	0.30	0.28	0.12	56.26	1.82	128.00	119.00	40.00
2929	Upper Rella	SIKAR	Neem Ka Thana	Shekhawati	Dohan	MINOR	27.663486	75.936024				1.11					212.00	
	Sub Basin Total										**21.71**	**25.44**				**4,879.00**	**5,392.95**	**3,203.00**
2176	Guda	JHUNJHUNUN	Khetri	Shekhawati	Kantli	MINOR	27.815834	75.659921				0.12					19.00	
2179	Madhogarh	JHUNJHUNUN	Khetri	Shekhawati	Kantli	MINOR	27.871266	75.700997	9.18	270.00	0.93	0.84	NA	115.81	1.00	201.00	200.00	120.00
2186	Siloti	JHUNJHUNUN	Khetri	Shekhawati	Kantli	MINOR	27.877144	75.743766	6.00	720.00	0.28	0.26	0.27	74.58	1.20	78.00	74.04	56.00
2178	Kanaksas	JHUNJHUNUN	Udaipurwati	Shekhawati	Kantli	MINOR	27.758192	75.640205				0.19					70.00	
2180	Mandarwa	JHUNJHUNUN	Udaipurwati	Shekhawati	Kantli	MINOR	27.741569	75.594788	10.51	270.00	0.36	0.32	NA	88.17	0.90	116.00	116.40	42.00
2181	Mavta	JHUNJHUNUN	Udaipurwati	Shekhawati	Kantli	MINOR	27.717783	75.619215	8.56	945.00	1.14	1.02	0.55 sq. km	74.36cumec	4.11	406.00	406.00	291.00
2182	Niran Ki dhani	JHUNJHUNUN	Udaipurwati	Shekhawati	Kantli	MINOR	27.726895	75.555949	8.88	650.00	1.26	1.10	0.542 sq. km	164.23cumec	1.93	307.00	306.80	164.00
2183	Pach Langi	JHUNJHUNUN	Udaipurwati	Shekhawati	Kantli	MINOR	27.727039	75.664245				0.65					133.00	
2184	Ponk	JHUNJHUNUN	Udaipurwati	Shekhawati	Kantli	MINOR	27.844371	75.609399	7.31	1,690.00	1.33	1.33	1.24 sq. km	111.05 cumec	2.74	868.00	819.00	819.00
2941	Bamerda	SIKAR	Khandela	Shekhawati	Kantli	Minor	27.642675	75.572064	7.40	1,330.00	1.04	0.92	0.79 sq. km	164.09cumec	3.15	372.00	337.30	270.00
2895	Barwada	SIKAR	Khandela	Shekhawati	Kantli	MINOR	27.666740	75.580020				0.45					136.00	
2914	Kalikhera	SIKAR	Khandela	Shekhawati	Kantli	MINOR	27.622460	75.596106	6.00	140.00	0.76	0.69	0.45	198.00	1.40	155.00	121.00	99.00
2915	Karoi	SIKAR	Khandela	Shekhawati	Kantli	MINOR	27.632182	75.566411	5.00	2,460.00	0.69	0.51	0.76	88.89	1.17	158.00	117.00	
2916	Khandela	SIKAR	Khandela	Shekhawati	Kantli	MINOR	27.609996	75.494476				0.52					95.00	
2921	Neemki	SIKAR	Khandela	Shekhawati	Kantli	MINOR	27.595935	75.586232	7.30	980.00	1.09	0.81	0.25	154.74	1.05	142.00	130.00	97.00
2939	Sewli	SIKAR	Khandela	Shekhawati	Kantli	Minor	27.650027	75.459781				0.26					46.00	
2896	Basdi	SIKAR	Neem Ka Thana	Shekhawati	Kantli	MINOR	27.648661	75.772449	5.50	1,500.00	0.54	0.48	0.44	94.46	0.40	170.00	157.00	138.00
2897	Bhudoli	SIKAR	Neem Ka Thana	Shekhawati	Kantli	MINOR	27.687581	75.774397	9.40	655.00	2.58	2.32	0.60 sq. km	237.72cumec	8.68	724.00	664.00	324.00
2905	Ganwari	SIKAR	Neem Ka Thana	Shekhawati	Kantli	MINOR	27.708333	75.841667	4.60	490.00	0.67	0.65	0.45	96.22	1.40	111.00	100.00	90.00
2925	Ranasar	SIKAR	Neem Ka Thana	Shekhawati	Kantli	MINOR	27.738564	75.714935	10.60	860.00	4.41	4.28	0.93 sq. km	458.46 cumec	8.04	1,165.00	1,018.00	624.00
	Sub Basin Total										**17.08**	**17.72**				**4,973.00**	**5,065.54**	**3,134.00**
156	Hanuman Sagar Ralwata	AJMER	Kishangarh	Shekhawati	Mendha	MINOR	26.686718	74.851410	NA	1,280.00	6.25	0.18	NA	1,338.00	0.64	24.00	24.30	20.00

S. No.	Project Name	District	Block	Basin	Sub-basin	Class	Latitude (DD)	Longitude (DD)	Ht. above Lowest Foundation (m)	Length of Dam (m)	Gross Storage Capacity (Mm^3)	Live Storage Capacity (Mm^3)	Reservoir Area at FRL (km^2)	Design Spilway Capacity (cusecs)	Length of Canal System (km)	Command Area (ha)		
																GCA	CCA	ICA
1	2	3	4	5	6	7	9	10	11	12	13	14	15	16	17	18	19	20
328	Rodawas	AJMER	Kishangarh	Shekhawati	Mendha	MINOR	26.711770	74.744148	NA	200.00	6.46	0.17	NA	1,200.00		41.00	34.10	23.00
332	Roopangarh	AJMER	Kishangarh	Shekhawati	Mendha	MINOR	26.803559	74.850124	NA	4,710.00		5.95	NA	34,502.00	10.46	1,414.00	840.00	890.00
44	Badliya Tank	AJMER	Srinagar	Shekhawati	Mendha	MINOR	26.445503	74.710657				0.57					85.00	
90	Bijolav Tank Narwar	AJMER	Srinagar	Shekhawati	Mendha	MINOR	26.589956	74.694530	NA	1,120.00	13.59	0.25	NA	13,489.00	2.19	111.00	101.10	60.00
143	Ghugra Talab	AJMER	Srinagar	Shekhawati	Mendha	MINOR	26.502154	74.686402	NA	1,280.00	10.92	0.25	NA	1,786.00	2.58	76.90	71.00	40.00
236	Makarwali Talab	AJMER	Srinagar	Shekhawati	Mendha	MINOR	26.549430	74.665086	NA	1,020.00	19.76	0.44	NA		1.27	113.00	100.00	61.00
246	Mohami Talab	AJMER	Srinagar	Shekhawati	Mendha	MINOR	26.503386	74.785641	NA	450.00	12.45	0.34	NA	2,675.00	3.32	76.90	68.80	40.00
294	Phool Sagar Gawadi	AJMER	Srinagar	Shekhawati	Mendha	MINOR	26.497004	74.724139				0.46					566.80	
295	Phool Sagar Kayad	AJMER	Srinagar	Shekhawati	Mendha	MINOR	26.542684	74.684075	NA	2,550.00	0.09	2.93	NA	8,238.00	8.90	404.70	364.00	219.00
312	Ram Sagar Nareli	AJMER	Srinagar	Shekhawati	Mendha	MINOR	26.456972	74.725391				0.51					69.00	
377	Untra	AJMER	Srinagar	Shekhawati	Mendha	MINOR	26.574786	74.770585	NA	3,075.00	0.09	2.83	NA	10,920.00	10.76	1,072.45	595.10	595.00
1870	Choti Dungri	JAIPUR	Sambhar	Shekhawati	Mendha	MINOR	27.158138	75.474091				3.27					635.70	
1950	Jetpura(Sambhar)	JAIPUR	Sambhar	Shekhawati	Mendha	Minor	26.949386	75.282988				1.02					40.00	
2487	Babdi Bund	NAGAUR	Kuchaman City	Shekhawati	Mendha	MINOR	27.129323	75.180724				1.61					62.16	
2592	Barjan	NAGAUR	Kuchaman City	Shekhawati	Mendha	Minor	27.070239	75.155314				0.05					22.00	
2502	Bhuni Bundh	NAGAUR	Kuchaman City	Shekhawati	Mendha	MINOR	27.131032	75.025068	7.10	1,268.00	0.72	0.73		55.02	-	59.03	34.15	51.24
2512	Dalelpura Bund	NAGAUR	Kuchaman City	Shekhawati	Mendha	MINOR	27.150551	75.037719				0.28					17.80	
2555	Panchota Bund	NAGAUR	Kuchaman City	Shekhawati	Mendha	MINOR	27.062524	75.015838				0.15					27.60	
2571	Zinwar Bund	NAGAUR	Kuchaman City	Shekhawati	Mendha	MINOR	27.123990	75.119481				0.14					24.44	
2518	Dhonkliya Bund	NAGAUR	Parbatsar	Shekhawati	Mendha	MINOR	26.959192	74.819514	5.00	346.00	1.22	1.21		80.08	1.80	164.13	43.64	39.62
2522	Gangwa Bund	NAGAUR	Parbatsar	Shekhawati	Mendha	MINOR	26.991113	74.767029				0.35					65.56	
2532	Karmakudi Bund	NAGAUR	Parbatsar	Shekhawati	Mendha	MINOR	26.880174	74.750385				0.26					44.52	
2543	Manghana Bund	NAGAUR	Parbatsar	Shekhawati	Mendha	MINOR	27.006909	74.794455				0.51					57.32	
2577	Manglana	NAGAUR	Parbatsar	Shekhawati	Mendha	Minor	27.027168	74.771865	7.60	250.00	1.13	0.59	NA	137.10	3.04	168.00	141.65	117.00
2590	Peerji ka Naka	NAGAUR	Parbatsar	Shekhawati	Mendha	Minor	27.011082	74.792393	10.00	106.68	1.47	1.13	806.80	246.21	4.41	485.64	242.82	161.88
2564	Runeja Bund	NAGAUR	Parbatsar	Shekhawati	Mendha	MINOR	26.938469	74.819332				0.18					76.24	
2899	Dantla New	SIKAR	Danta Ramgarh	Shekhawati	Mendha	MINOR	27.367569	75.259094				0.10					19.00	
2900	Dantla Old	SIKAR	Danta Ramgarh	Shekhawati	Mendha	MINOR	27.370473	75.277022				0.13					19.00	
2903	Dukiya	SIKAR	Danta Ramgarh	Shekhawati	Mendha	MINOR	27.416426	75.344295	4.50	1,360.00	0.28	0.25	0.18	57.98		79.00	78.00	68.00
2906	Govati	SIKAR	Danta Ramgarh	Shekhawati	Mendha	MINOR	27.435160	75.349826	7.00	1,240.00	0.32	0.29	0.22	65.57	151.00	119.00	118.00	83.00
2917	Kheru Chandpura	SIKAR	Danta Ramgarh	Shekhawati	Mendha	MINOR	27.358877	75.320258				0.28					50.00	
2928	Surera	SIKAR	Danta Ramgarh	Shekhawati	Mendha	MINOR	27.183316	75.135625	6.00	320.00	0.34	0.30	0.39	68.03	0.75	77.00	62.00	43.00
	Sub Basin Total										**75.09**	**27.73**				**4,485.75**	**4,800.80**	**2,511.74**
	Basin Total										**92.17**	**45.46**				**9,458.75**	**9,866.34**	**5,645.74**
2946	Badechi	SIROHI	Reodar	Sukli	Sukli	MINOR	24.515841	72.458271	10.00	1,002.00	0.69	0.69	0.21	3,600.00	1.60	199.19	130.00	90.28
2948	Badon Ka Padar	SIROHI	Reodar	Sukli	Sukli	MINOR	24.493247	72.472102	10.80	814.93	0.39	0.39	0.14	3,885.00	1.20	105.26	73.65	51.82
2952	Butri	SIROHI	Reodar	Sukli	Sukli	MINOR	24.533958	72.538488	9.29	832.31	4.43	4.30	1.56	10,504.00	9.25	746.66	645.00	451.23
2958	Dolpura	SIROHI	Reodar	Sukli	Sukli	MINOR	24.562818	72.573259				1.03					213.00	
2964	Jirawal	SIROHI	Reodar	Sukli	Sukli	MINOR	24.673005	72.471450	12.76	616.18	1.95	1.95	0.16	5,164.00	5.50	335.22	290.00	203.64
2970	Kana Kolar	SIROHI	Reodar	Sukli	Sukli	MINOR	24.623260	72.481020	5.94	405.00	36.52	1.04	180.00	1,084.00	2,500.00	131.53	131.00	98.34
2971	Karodidhaj	SIROHI	Reodar	Sukli	Sukli	MINOR	24.618016	72.614937	13.00	1,840.00	2.69	2.57	0.56	4,600.00	5.92	544.31	505.00	420.48
2977	Mandar Nallah Ist	SIROHI	Reodar	Sukli	Sukli	MINOR	24.546633	72.402373	5.11	618.00	2,088.00	2.22	0.85	1,285.00	8.65	587.21	536.00	510.32
2978	Mandar Nallah Vth (Abonded)	SIROHI	Reodar	Sukli	Sukli	MINOR	24.572679	72.435460				-					-	
2988	Panchdeval	SIROHI	Reodar	Sukli	Sukli	MINOR	24.692158	72.501017	12.50	960.00	1.57	1.45	0.44	6,383.00	2.60	475.00	450.00	337.50
2993	Sangrli Khera	SIROHI	Reodar	Sukli	Sukli	MINOR	24.646288	72.703401	10.57	593.90	0.99	0.99	0.21	3,206.00	2.40	247.77	196.00	131.58
2995	Sukli innundation	SIROHI	Reodar	Sukli	Sukli	MINOR	24.609613	72.522040				9.90					1,510.00	
2997	Thal	SIROHI	Reodar	Sukli	Sukli	MINOR	24.575020	72.617298	8.90	1,329.27	0.61	0.61	0.28	1,960.00	1.00	85.83	78.91	46.96
2998	Tokra	SIROHI	Reodar	Sukli	Sukli	MINOR	24.687755	72.710057	10.82	1,231.40	5.44	5.20	2.09	10,867.00	9.60	1,463.78	1,072.00	744.64
2999	Udwariya	SIROHI	Reodar	Sukli	Sukli	MINOR	24.704027	72.738073	14.08	1,413.93	3.24	2.97	0.82	6,320.00	6.00	677.86	566.00	374.34
2992	Ranelav	SIROHI	Sirohi	Sukli	Sukli	MINOR	24.755007	72.652803	4.87	518.00	0.24	0.23	0.15	1,718.00	1.20	50.60	48.00	38.87
	Basin Total										**2,146.76**	**35.54**				**5,650.22**	**6,444.56**	**3,500.00**
2949	Bageri	SIROHI	Abu Road	West Banas	West Banas	MINOR	24.524293	72.688530				3.86					778.00	
2954	Chandlaw	SIROHI	Abu Road	West Banas	West Banas	MINOR	24.524164	72.639601	3.39	792.68	1.59	1.59	0.51	1,560.00	0.66	374.90	284.00	208.50
2955	Chinar	SIROHI	Abu Road	West Banas	West Banas	MINOR	24.479097	72.653049	15.37	255.00	1.52	1.46	0.32	4,576.00	2.70	448.40	368.00	208.42
2960	Girwar	SIROHI	Abu Road	West Banas	West Banas	MINOR	24.491898	72.643861	12.97	814.02	2.40	2.26	0.91	4,335.00	3.15	396.20	355.00	246.86
2968	Kala Data	SIROHI	Abu Road	West Banas	West Banas	MINOR	24.485491	72.845880	10.00	231.00	0.23	0.22	0.06	1,718.00	1.20	33.55	33.74	30.74
3010	Khara Dam	SIROHI	Abu Road	West Banas	West Banas	Minor	24.414317	72.707630	7.64	190.00	24.85	0.70	252.90	2,970.00	233.00	223.00	167.00	117.00
2974	Kui Sagna	SIROHI	Abu Road	West Banas	West Banas	MINOR	24.466078	72.803502	15.40	372.24	2.00	1.80	0.45	5,204.00	4.00	408.74	393.00	193.85
2976	Mahadev Nallah	SIROHI	Abu Road	West Banas	West Banas	MINOR	24.531170	72.698636	14.56	669.88	1.44	1.43	0.33	4,487.00	3.80	442.74	318.00	204.37
2979	Mandowari	SIROHI	Abu Road	West Banas	West Banas	MINOR	24.455733	72.774107				0.61					146.00	
2983	Moongthala	SIROHI	Abu Road	West Banas	West Banas	MINOR	24.488752	72.726868	10.25	4,160.00	2.70	2.58	1.04	8,450.00	3.10	683.12	580.00	369.08
2986	Ore Nallah	SIROHI	Abu Road	West Banas	West Banas	MINOR	24.481913	72.830156	9.35	353.00	0.27	0.26	0.84	1,540.00	0.60	82.30	72.00	71.63
3000	Vajna	SIROHI	Abu Road	West Banas	West Banas	MINOR	24.524886	72.639645	9.30	345.00	0.43	0.42	0.15	2,740.00		71.63	59.00	55.85
2951	Bhula Dam	SIROHI	Pindwara	West Banas	West Banas	MINOR	24.590127	72.989865	20.00 "	1,344.00	5.38	5.25	763.90	28.32	105 CH /105 CH	987.04	987.00	748.58
2959	Fhatkeshwar Dam	SIROHI	Pindwara	West Banas	West Banas	MINOR	24.650000	72.916667				0.44					140.00	
3008	Gangajali	SIROHI	Pindwara	West Banas	West Banas	Minor	24.658339	72.867458	8.40	2,460.00	1.84	1.75	0.65	8,834.00	0.55	700.00	350.00	299.88

S. No.	Project Name	District	Block	Basin	Sub-basin	Class	Latitude (DD)	Longitude (DD)	Ht. above Lowest Foundation (m)	Length of Dam (m)	Gross Storage Capacity (Mm^3)	Live Storage Capacity (Mm^3)	Reservoir Area at FRL (km^2)	Design Spilway Capacity (cusecs)	Length of Canal System (km)	Command Area (ha)		
																GCA	CCA	ICA
1	2	3	4	5	6	7	9	10	11	12	13	14	15	16	17	18	19	20
2965	Jubli	SIROHI	Pindwara	West Banas	West Banas	MINOR	24.713814	73.030181	NA	390.00	9.33	1.62	NA	3,163.00	1.56	123.00	230.00	49.00
2966	Kadambari Dam	SIROHI	Pindwara	West Banas	West Banas	MINOR	24.782262	73.074375				4.37					717.00	
2972	Ker Dam	SIROHI	Pindwara	West Banas	West Banas	MINOR	24.747363	72.858916	11.15 "	6,800.00	3.04	2.77	694.00	212.40	139 CH	405.26	389.00	279.92
2975	Luneri	SIROHI	Pindwara	West Banas	West Banas	MINOR	24.551438	72.970463	11.40	5,320.00	2.44	2.44	422.50	138.77	75 CH	410.37	215.00	164.71
2981	Mandwara Dam	SIROHI	Pindwara	West Banas	West Banas	MINOR	24.729150	72.863573				2.16					412.00	
3009	Modana	SIROHI	Pindwara	West Banas	West Banas	Minor	24.693340	72.929545				1.87					299.00	
2984	Moras Dam	SIROHI	Pindwara	West Banas	West Banas	MINOR	24.666667	73.083333	20.89	568.00	1.46	1.29	202.30	74.00	4400 M	435.00	219.00	185.00
2994	Sarup Sagar dam	SIROHI	Pindwara	West Banas	West Banas	MINOR	24.858762	73.045030				2.61					363.00	
3001	Valoriya	SIROHI	Pindwara	West Banas	West Banas	MINOR	24.594075	73.010958	21.39	570.00	1.58	1.54	0.16	9,870.00	5.08	504.85	405.00	306.18
3004	Watera	SIROHI	Pindwara	West Banas	West Banas	MINOR	24.609886	72.916244				1.13					163.00	
	Basin Total										**62.49**	**46.43**				**6,730.10**	**8,442.74**	**3,739.57**

Appendix 5(a)

Inventory of Ongoing Projects

S. No.	Name of Project	Basin	Nearest City	District	Block Name	Sub-basin	Longitude (DD)	Latitude (DD)	Gross Storage Capacity, Mm^3	Live Storage Capcity, Mm^3	Reservoir Area at FRL, km^2	Length of Dam in, km	GCA in ha	CCA in ha	ICA in ha	Free Catchment Area, km^2	Gross Catchment Area, km^2	MWL (m)	FTL (m)	Sill RL (m)
1	Abar Sagar Minor Extension	Banganga	Kumher	Bharatpur	Kumher	Banganga	77.459100	27.324680	Extension of Minor Canal	Extention of minor	Extension of Minor Canal	Extension of Minor Canal	2500.00 (Command Area of extension part)	1998.00	1998.00	-	-	-	-	-
2	Lakhana Minor Extension	Banganga	Kumher	Bharatpur	Kumher	Banganga	77.409800	27.331030	Minor Canal	Extention of minor	Extension of Minor Canal		3100.00 (Command Area of extension part)	1989.00	1989.00	Nil	Nil	Extension of Minor		
3	Bageri Ka Naka	Banas	Khmnor	Rajsamand	Khamnor	Banas	73.594960	24.911207	8.23	8.23	-	-	Water Supply Scheme	Only for drinking water	-	-	-	-	-	-
4	Khoh Mr. Irrig. Project	Banas	Sapotra	Karauli	Sapotra	Kalisil	76.716230	26.186540	20.057	13.514	2.13	1.093	1523.00	1371.00	959.49	111.36	132.08	62.30	59.50	51.20
5	Parwati Sagar	Banas	Raipur	Bhilwara	Raipur	Kothari	74.200800	25.380400	0.53	0.46	-	-	74.00	73.00	-	-	-	-	-	-
6	Ahamadi Irrig. Project	Chambal	Kishanganj	Baran	Kishanganj	Parwati	76.720890	24.999370	4.10	3.48	2.07	2.341	930.00	635.00	444.00	25.40	25.40	308.1	307.1	304.34
7	Balapura Mr.Irrig. Lift	Chambal	RMC Of Chamble	Kota	Ladpura	Chambal Downstream	75.984722	25.115278	Canal Lift Scheme (R.M.C, of Chamble)				2067.00	1900.00	1550.00	-	-	-	-	-
8	Bhimni	Chambal	Dag	Jhalawar	Dag	Kali Sindh	75.838530	24.115580	12.10	9.39	-	1.59	1961.15	1948.00	1948.00	51.50	66.00	-	-	-
9	Danta Mr.Irrig. Project	Chambal	Sangod	Kota	Sangod	Kali Sindh	76.169070	24.781050	1.56	1.50	-	-	290.00	267.00	275.00	-	9.50	114.70	114	-
10	Gararda	Chambal	Bundi	Bundi	Bundi	Mej	75.483200	25.192590	44.38	41.94	-	-	10492.00	9161.00	-	-	-	-	-	-
11	Gulandi Mr. Irrig. Project	Chambal	Aklera	Jhalawar	Bakani	Kali Sindh	76.584120	24.369000	13.377	9.305	-	2.22	2341.00	1950.00	-	-	79.50	330.10	328.60	325.50
12	Kalisindh Irrigation	Chambal	Jhalarapatan	Jhalawar	Jhalrapatan	Kali Sindh	76.220630	24.497830	147.69	147.27	40.52	0.955	16633.64	14478.00	-	7325.00	7547.00	319.3	319.25	306.00
13	Kanwara Mr. Irrig. Project	Chambal	Jhalarapatan	Jhalawar	Jhalrapatan	Kali Sindh	76.027220	24.465510	9.47	9.47	-	-	2052.00	1710.00	-	-	-	-	-	-
14	Kheriya Irrig. Project	Chambal	Shahabad	Baran	Shahbad	Parwati	76.910480	25.107710	0.667	0.668	-	-	190.00	172.00	154.08	3.50	3.50	105.3	105.25	99.25
15	Kishanpura irrig.Project	Chambal	RMC Of Chamble	Kota	Ladpura	Chambal Downstream	75.987460	25.124981	Canal Lift Scheme (R.M.C, of Chamble)				2097.00	1938.69	1455.00	-	-	-	-	-
16	Kishor Pura Mr. Irrig.	Chambal	Sangod	Kota	Sangod	Kali Sindh	76.084750	24.975120	0.67	0.64	17.31	0.885	205.83	178.00	164.00	-	4.25	113.90	113.30	106.50
17	Ladpura Mr Irrig. Project	Chambal	NA	Kota	Sangod	Kali Sindh	76.072720	24.920270	0.71	0.68	-	1.65	212.53	192.00	180.00	-	4.50	105.80	105.20	102.00
18	Prithipurai Mr. Irrig. Project	Chambal	Aklera	Jhalawar	Jhalrapatan	Kali Sindh	76.285510	24.543980	0.54	0.50	-	0.629	110.00	110.00	-	-	2.81	105.30	104.50	99.00
19	Rewa	Chambal	Jhalarapatan	Jhalawar	Jhalrapatan	Kali Sindh	75.956940	24.526600	12.00	9.20	-	-	2245.00	1704.00	2105.00	364.00	-	-	-	-
20	Akoli Irrig. Project	Luni	Jalore	Jalore	Jalore	Khari	72.597250	25.145150	1.72	1.607	0.83	3.40	679.00	539.00 / 192.00	458.00	Jalore	97.90	96.25	94.00	-
21	Bagdari Mr. Irrig. Project	Mahi	Choti Sadri	Chittaurgarh	Chhoti Sadri	Jakham	74.767930	24.376520	0.89058	0.8017	0.412	-	180.90	161.00	184.00	4.14	4.14	95.90	94.80	91.00
22	Bhanwar Semla Project	Mahi	Peepalkhoont	Pratapgarh	Pratapgarh	Mahi	74.731230	23.988150	9.43	9.06	-	335.00	2020.00	1727.12	1295.04	64.80	64.80	463.00	463.00	448.30
23	Boriwan Garhi	Mahi	Peepalkhoont	Pratapgarh	Peepalkhoont	Mahi	74.745370	23.818120	3.20	2.47	-	-	572.00	493.00	-	-	-	-	-	-

S. No.	Name of Project	Basin	Nearest City	District	Block Name	Sub-basin	Longitude (DD)	Latitude (DD)	Gross Storage Capacity, Mm^3	Live Storage Capcity, Mm^3	Reservoir Area at FRL, km^2	Length of Dam in, km	GCA in ha	CCA in ha	ICA in ha	Free Catchment Area, km^2	Gross Catchment Area, km^2	MWL (m)	FTL (m)	Sill RL (m)
24	Pharaswali Ki Dhani	Outside Basin	Piprali	Sikar	Piprali	No Reference	75.341700	27.556050	0.90	0.86	-	-	379.00	345.00	-	-	-	-	-	-
25	Mamer Irrig. Project	Sabarmati	Kotra	Udaipur	Kotra	Sabarmati	73.164992	24.170663	2.19	1.992	N.A	170.00	396.00	336.00	403(R-303,k-100.0)	17.06	17.06	121.90	120.00	108.50
26	Sabarmati irrig. Project	Sabarmati	Kotra	Udaipur	Kotra	Sabarmati	73.203664	24.573119	18.57	16.72	-	0.40	1410.24	956.00	855.00	205.50	205.50	401.00	397.00	384.60
27	Pach Pahari	Sabi	Virat Nagar	Jaipur	Viratnagar	Sabi	76.181910	27.547370	1.37	1.22	-	-	249.60	208.00	-	-	-	-	-	-
28	Bhaisa Singh	West Banas	Abu Road	Sirohi	Abu Road	West Banas	72.736940	24.411750	5.07	5.07	-	0.188	450.40	419.00	349.50	-	40.145	150.8	149.00	138.07

Appendix 5(b)
Inventory of Proposed Projects

S. No.	Name of Project	Basin	Nearest City	District	Block Name	Sub-basin	Longitude (DD)	Latitude (DD)	Gross Storage Capacity, Mm^3	Live Storage Capcity, Mm^3	Reservoir area at FRL, km^2	Length of Dam in, km	GCA in ha	CCA in ha	ICA in ha	Free Catchment Area, km^2	Gross Catchment Area, km^2	MWL (m)	FTL (m)	Sill RL (m)
1	Anwa Irrig Project	Chambal	Sangod	Kota	Sangod	Kali Sindh	76.109690	24.928670	0.76	0.72	17.85	1.20	202.43	187.20	159.20	-	8.25	105.90	105.25	100.50
2	Parwan Irrig	Chambal	Khanpur	Jhalawar	Khanpur	Kali Sindh	76.518600	24.595950	490.00	462.00	98.10	0.36	154787.00	131400.00	-	1622.00	2262.00	309.30	308.80	294.60
				Water Reserved for (A) Irriration - 317 M-Cum (B) Power Project - 79 M-Cum (C) Drinking - 50 M-Cum (D) Wield Life -16 M-Cum																
3	Naveli Irrig Project	Chambal	Kishanganj	Baran	Shahbad	Parwati	77.118260	25.155380	3.93	3.65	-	-	737.00	614.00	522.00	19.50	20.75	92.15	91.30	87.10
4	Radi Irrig Project	Chambal	Kishanganj	Baran	Shahbad	Parwati	76.868510	25.145110	7.10	4.92	-	-	1001.00	901.00	811.00	27.78	27.78	251.20	250.00	244.50
5	Hatiyadeh Irrig Project	Chambal	Kishanganj	Baran	Kishanganj	Parwati	76.705890	25.265790	46.97	42.97	-	-	10091.00	6885.00	6128.00	269.31	269.31	261.00	259.27	253.50
6	Andheri Irrig Project	Chambal	Chabbra	Baran	Chhipabarod	Parwati	76.791310	24.576880	45.29	37.28	-	-	8300.00	7700.00	9625.00	304.87	304.87	341.25	341.25	336.00
7	Guradia MrIrrigProject	Chambal	Pirawa	Jhalawar	Pirawa	Kali Sindh	76.075920	24.410570	4.493	4.09	-	1.935	1737.00	1509.00	1509.00	38.20	38.2	357.50	356.00	351.00
8	Borband Mr Irrig Project	Chambal	Bakani	Jhalawar	Bakani	Kali Sindh	76.527350	24.174720	0.672	0.55	-	0.197	133.00	133.00	133.00	3.1125	6.37	368.70	367.20	364.50
9	Rizone Mr Irrig Project	Chambal	Jhalarapatan	Jhalawar	Bakani	Kali Sindh	76.279530	24.358540	0.63	0.60	-	-	-	129.00	-	-	-	-	105.30	99.70
10	Dohri Mr Irrig Project	Chambal	Sapotra	Karauli	Sapotra	Chambal Downstrea	76.927390	26.151100	8.11	6.09	1.58	1.11	1253.00	1002.43	701.70	57.24	57.24	231.20	230.00	225.10
11	Gopal Sagar Mr Irrig Project	Chambal	Mandrial	Karauli	Sapotra	Chambal Downstrea	77.227390	26.349880	-	1.38	39.60	-	-	198.00	-	10.75	10.75	-	-	-
12	Ram Sagar Mr Irrig Project	Chambal	Mandrial	Karauli	Sapotra	Chambal Downstrea	77.317030	26.382830	-	1.67	0.476	-	-	238.00	-	13.00	13.00	-	-	-
13	Krishna Sagar Mr Irrig Project	Chambal	Karanpur	Karauli	Sapotra	Chambal Downstrea	77.104210	26.270830	-	7.07	2.02	-	-	1012.00	-	40.25	40.25	-	-	-
14	Manoharthana irrig Project	Chambal	Manoharthana	Jhalawar	Manohar Thar	Kali Sindh	76.808040	24.218540	84.76	63.09	-	2.885	14049.61	9834.00	16202.00	1159.00	1176.00	346.80	346.30	340.00
15	Bherupura	Chambal	Khanpur	Jhalawar	Khanpur	Kali Sindh	76.426050	24.826280	1.05	1.05	-	-	-	150.00	-	-	-	-	-	-
16	Mala Devi	Chambal	Bhainsrorgarh	Chittorgarh	Bhainsrorgarh	Chambal Upstream	75.333710	25.011420	-	0.71	-	-	-	153.00	-	-	-	-	-	-
17	Sathoor Mata	Chambal	Hindoli	Bundi	Hindoli	Mej	75.518390	25.443990	0.90	0.83	-	0.76	247.00	209.00	173.00	9.06	9.06	317.50	316.00	312.00
18	Pipalda Lift Irrig Scheme	Chambal	Khandar	Sawai Madhopur	Khandar	Chambal Downstrea	76.647240	25.910480	23.26	23.26	-	-	-	12930.00	-	-	-	-	-	-
19	Indra Lift Irrig Scheme	Chambal	Khandar	Sawai Madhopur	Khandar	Chambal Downstrea	76.818930	26.003450	205.26	205.26	-	-	-	104845.00	-	-	-	-	-	-
20	Dholpur Lift Irrig Scheme	Chambal	Dholpur	Dholpur	Dhaulpur	Chambal Downstrea	77.931170	26.661740	74.70	74.70	-	-	-	34465.00	-	-	-	-	-	-
21	Rajgarh Project	Chambal	Pachpahar	Jhalawar	Jhalrapatan	Kali Sindh	75.887500	24.246667	58.29	43.44	-	-	7536.00	6827.00	8568.00	266.00	588.00	379.80	379.20	374.00
22	Chambal Panchana Jaggar Lift	Chambal	Karauli	Karauli	Karauli	Gambhir	77.015664	26.561821	25.00	25.00	-	-	-	3135.00	-	-	-	-	-	-
23	Bada Nayagaon	Chambal	Hindoli	Bundi	Hindoli	Mej	75.504300	25.509790	5.86	5.28	2.87	1.20	895.00	758.00	606.00	182.25	173.19	270.00	268.50	264.00
24	Amlipura MrIrrig Project	Mahi	Kushalgarh	Banswara	Kushalgarh	Mahi	74.524340	23.204170	1.28	1.15	-	-	-	164.00	164.00	3.80	3.80	-	-	-
25	Nal irrig Project	Mahi	Bgidora	Banswara	Ghatol	Mahi	74.475910	23.652110	1.00	0.90	-	-	143.00	129.00	-	6.525	6.525	-	-	-

S. No.	Name of Project	Basin	Nearest City	District	Block Name	Sub-basin	Longitude (DD)	Latitude (DD)	Gross Storage Capacity, Mm^3	Live Storage Capcity, Mm^3	Reservoir area at FRL, km^2	Length of Dam in, km	GCA in ha	CCA in ha	ICA in ha	Free Catchment Area, km^2	Gross Catchment Area, km^2	MWL (m)	FTL (m)	Sill RL (m)
26	Moti-Tambi Mr Irrig Prog	Mahi	Moti Tambi	Banswara	Bagidora	Anas	74.154444	23.288333	2.70	2.43	-	-	-	347.00	143.00	22.175	22.175	-	-	-
27	Ghoda Khoj Dam	Mahi	Kherwara	Udaipur	Rishabhdeo	Som	73.535690	24.202480	2.83	2.38	-	145.00	586.00	425.00	389.00	50.00	50.00	123.20	121.00	111.00
28	Zawar Anicut	Mahi	Sarada	Udaipur	Sarada	Som	73.918770	24.326390	Diversion Scheme		-	-	-	1894.00	-	204.30	343.60	-	-	-
29	Piplon Mr Irrig Project	Mahi	Kushalgarh	Banswara	Kushalgarh	Mahi	74.604943	23.244598	4.30	3.95	-	-	837.65	771.52	-	11.77	14.50	497.10	495.90	485.00
30	Tidiyadeo Irrig Project	Mahi	Sajjangarh	Banswara	Sajjangarh	Anas	74.330330	23.236630	2.518	2.26	-	-	356.00	232.00	-	6.47	6.47	488.50	487.50	478.00
31	Handa Khera	Mahi	Dhariabad	Banswara	Dhariawad	Jakham	74.364840	24.025860	-	13.97	-	-	-	1998.00	-	-	-	-	-	-
32	Mokha tok ka naka	Mahi	Pipalkhunt	Pratapgarh	Arnod	Mahi	74.783940	23.771590	-	2.00	-	-	-	412.00	-	-	-	-	-	-
33	Pind Irrig Project	Banas	Bara Sadri	Chittaurgar	Bari Sadri	Berach	74.496840	24.499550	5.68	5.13	-	-	1012.00	809.00	1023.00	20.46	20.46	467.95	466.45	462.55
34	Isarda 2nd	Banas	Unira	Tonk	Uniara	Banas	76.006950	26.109890	304.97	304.09	65.00	-	-	WSP	-	-	-	-	-	-
35	Sawidar	Luni	Jaswantpura	Jalore	Jaswantpura	Sagi	72.322450	24.923490	1.88	1.46	-	1.504	818.00	737.00	627.00	31.23	42.37	101.80	99.47	-
36	Dham Dhama Reservoir	Sabarmati	Gogunda	Udaipur	Kotra	Sabarmati	73.148320	24.465170	0.66	0.60	0.175	110.00	WSP	WSP	WSP	11.11	-	83.50	82.00	70.05
37	Ubapana irrig Project	Sabarmati	Kotra	Udaipur	Jhadol	Wakal	73.362570	24.366740	0.68	0.62	-	93.00	211.24	153.00	91.62	5.58	5.58	93.60	92.00	83.50
38	Kodarmal	Sabarmati	Kotra	Udaipur	Kotra	Sei	73.126900	24.521940	-	0.25	-	-	-	56.00	-	-	-	-	-	-
39	Harmatia	Sukli	Reodar	Sirohi	Reodar	Sukli	72.667650	24.611060	2.45	2.33	0.294	2.72	807.96	699.00	400.37	7.53	7.53	91.70	90.20	86.00
40	Vasa	West Banas	Pindwara	Sirohi	Pindwara	West Banas	72.981060	24.625850	3.24	3.10	1.694	0.417	465.61	400.00	370.00	62.25	105.62	278.45	276.15	268.15

Appendix 6
River Gauge and Discharge (G&D) Sites

S. No.	G&D Site	River/ Stream	Basin	Maintained By
1	Chittorgarh	Berach	Banas	WRD
2	Chittorgarh	Gambhiri	Banas	WRD
3	Kanota	Dhund	Banas	WRD
4	Matrikundia Pick up-weir	Banas	Banas	WRD
5	Wagon	Banas	Banas	WRD
6	Gomti	Chhaper Kheri	Banas	WRD
7	Kothari	Banas	Banas	WRD
8	Negaria	Banas	Banas	WRD
9	Hingota	Banganga	Banganga	WRD
10	Shri Mahavirji	Gambhir	Gambhir	WRD
11	Samogarh Railway Bridge	Gambhir	Gambhir	WRD
12	Bayana Railway Station	Gambhir	Gambhir	WRD
13	Rana Pratap Sagar Dam	Chambal	Chambal	WRD
14	Jawahar Sagar Dam	Chambal	Chambal	WRD
15	Kota Barrage	Chambal	Chambal	WRD
16	Manohar Thana	Parwan	Chambal	WRD
17	Kalisindh Pick-up weir	Kalisindh	Chambal	WRD
18	Parwan Pick-up weir	Chambal	Chambal	WRD
19	Govindgarh	Saraswati	Banas	WRD
20	Mahi Dam	Mahi	Mahi	WRD
21	Dhariawad	Jakham	Mahi	WRD
22	Nagalia Pick-up-weir	Mahi	Mahi	WRD
23	Karmai Pick-up-weir	Mahi	Mahi	WRD
24	Aspur	Som	Mahi	WRD
25	Sodawas	Sabi	Sabi	WRD
26	Ringus (site closed)	Mendha	Shekhawati	CWC
27	Nimoda	Morel	Banas	CWC
28	Pipli	Banas	Banas	CWC
29	Tonk	Banas	Banas	CWC
30	Pali Ghat	Chambal	Chambal	CWC
31	Mandawara	Chambal	Chambal	CWC
32	Aklera	Parwan	Chambal	CWC
33	Sangod	Parwan	Chambal	CWC
34	Barod	Kali Sindh	Chambal	CWC
35	Khatoli	Parwan	Chambal	CWC
36	Salwad	Kali Sindh	Chambal	CWC
37	Mandrail	Chambal	Chambal	CWC
38	Chittorgarh	Gambhiri	Banas	CWC
39	Bigod	Banas	Banas	CWC
40	Baranwada	Banas	Banas	CWC
41	Dholpur	Chambal	Chambal	CWC
42	Rangeli	Som	Mahi	CWC
43	Anas at PH2	Anas	Mahi	CWC
44	Chandangarh/ Mataji	Mahi	Mahi	CWC
45	Paderdibadi	Mahi	Mahi	CWC

S. No.	G&D Site	River/ Stream	Basin	Maintained By
46	Kadana	Mahi	Mahi	CWC
47	Gandhav/Chitalvana	Luni	Luni	CWC
48	Akdara (site closed)	Mithri	Luni	CWC
49	Birami (site closed)	Ugti	Luni	CWC
50	Sojat Road (site closed)	Sukri	Luni	CWC
51	Alniawas (site closed)	Luni	Luni	CWC
52	Abu Road	West Banas	West Banas	CWC

Appendix 7
Water Harvesting Structures (WHSs) in Rajasthan
(Upto 2007, updated till Oct-Nov 2010)

Digitization of WHSs

There are numerous water harvesting structures constructed and watershed works carried out, locations of which are identified on satellite images (LISS III, post-monsoon 2010) procured from NRSA, Hyderabad in addition to water bodies as received from SRSAC, Jodhpur (till 2007).

Following processes was carried out for creating WHSs database and mark them on GIS platform alongwith hydrological details.

- Post monsoon cloud free LISS III satellite images were procured from NRSA, Hyderabad (post-monsoon 2010).
- Images were georeferenced to their real world coordinates.
- Classification process in supplement to digitization of water bodies visible in satellite imageries were carried out to extract additional water bodies locations alongwith spread area (visible water bodies like lakes, tanks, ponds, and other man made WHSs upto 2 ha area were digitized and shown on maps against 50 ha as mentioned in TOR).
- Water bodies are stored and marked on GIS platform for mapping and modelling purpose.
- The WHSs captured includes the new WHSs constructed under various watershed works that is carried out across the basins.

Details of WHS constructed after 2007

The details of WHSs constructed upto year 2007 and additional WHSs constructed upto Oct-Nov 2010 are shown below.

Table 1: WHS Constructed between Year 2007 and Year 2010 in Various Basins

Basin	Sub-basin	Upto Year 2007*	Additional WHS Constructed upto Year 2010#	Total WHS	% increase in WHS Count
Banas	Banas	6,988	88	7,076	1.26
	Berach	4,039	66	4,105	1.63
	Dain	2,888	20	2,908	0.69
	Gudia	815	6	821	0.74
	Kalisil	247	7	254	2.83
	Khari	5,502	73	5,575	1.33
	Kothari	1,863	23	1,886	1.23
	Mashi	4,097	88	4,185	2.15
	Morel	2,887	35	2,922	1.21
	Sodra	1,803	37	1,840	2.05
Basin Summary		**31,129**	**443**	**31,572**	**1.42**

Basin	Sub-basin	Upto Year 2007*	Additional WHS Constructed upto Year 2010#	Total WHS	% increase in WHS Count
Banganga	Banganga	4,009	30	4,039	0.75
Basin Summary		**4,009**	**30**	**4,039**	0.75
Chambal	Chakan	223	4	227	1.79
	Chambal Downstream	1,341	17	1,358	1.27
	Chambal Upstream	1,173	53	1,226	4.52
	Kali Sindh	3,244	56	3,300	1.73
	Kunu	168	6	174	3.57
	Mej	1,801	63	1,864	3.50
	Parwati	1,325	57	1,382	4.30
Basin Summary		**9,275**	**256**	**9,531**	**2.76**
Gambhir	Gambhir	1,895	18	1,913	0.95
Basin Summary		**1,895**	**18**	**1,913**	0.95
Ghaggar	Ghaggar		97	97	--
Basin Summary			**97**	**97**	--
Luni	Bandi	248	0	248	0.00
	Bandi (Hemawas)	562	5	567	0.89
	Guhiya	1,493	12	1,505	0.80
	Jawai	735	2	737	0.27
	Jojri	1,879	45	1,924	2.39
	Khari	1,102	3	1,105	0.27
	Khari (Hemawas)	395	8	403	2.03
	Luni	3,782	488	4,270	12.9
	Mithari	746	0	746	0.00
	Sagi	430	5	435	1.16
	Sukri	1,373	7	1,380	0.51
	Sukri (Sayala)	158	0	158	0.00
Basin Summary		**12,903**	**575**	**13,478**	**4.46**
Mahi	Anas	542	22	564	4.06
	Bhadar	73	1	74	1.37
	Jakham	477	14	491	2.94
	Mahi	1,741	39	1,780	2.24
	Moran	185	9	194	4.86
	Som	1,872	22	1,894	1.18
Basin Summary		**4,890**	**107**	**4,997**	**2.19**
Other Nallahs of Jalore	Other Nallahs of Jalore	605	5	610	0.83
Basin Summary		**605**	**5**	**610**	**0.83**
Outside Basin	Fragmented		18	18	SRSAC data on WHS for this region was not available, WHS are fresh captured from Satellite images.
	Sub 1		111	111	
	Sub 2		32	32	
	Sub 3		506	506	
	Sub 4		206	206	
	Sub 5		599	599	
	Sub 6		195	195	

Basin	Sub-basin	Upto Year 2007*	Additional WHS Constructed upto Year 2010#	Total WHS	% increase in WHS Count
Basin Summary			**1,667**	**1,667**	
Parbati	Parbati	707	20	727	2.83
Basin Summary		**707**	**20**	**727**	**2.83**
Ruparail	Ruparail	1,557	2	1,559	0.13
Basin Summary		**1,557**	**2**	**1,559**	**0.13**
Sabarmati	Sabarmati	138	0	138	0.00
	Sei	109	0	109	0.00
	Vatrak	387	0	387	0.00
	Wakal	247	1	248	0.40
Basin Summary		**881**	**1**	**882**	**0.11**
Sabi	Sabi	1,415	21	1,436	1.48
Basin Summary		**1,415**	**21**	**1,436**	**1.48**
Shekhawati	Dohan	546	20	566	3.66
	Kantli	483	0	483	0.00
	Mendha	1,372	7	1,379	0.51
Basin Summary		**2,401**	**27**	**2,428**	**1.12**
Sukli	Sukli	545	0	545	0.00
Basin Summary		**545**	**0**	**545**	**0.00**
West Banas	West Banas	545	3	548	0.55
Basin Summary		**545**	**3**	**548**	**0.55**

* Source: SRSAC waterbody database, 2007

Source: WHS extracted using post monsoon (Oct-Nov) satellite images of year 2010.

Appendix 8

Micro-watershed wise Groundwater Availability

Table 1: Basin/ Sub-basin/ Micro-watershed wise Groundwater Availability

Basin	Sub-basin	Micro Watershed	Dynamic Groundwater Availability, Mm^3		Static Groundwater Availability, Mm^3	
			Fresh	Saline	Fresh	Saline
Shekhawati	Dohan	001	7.71	-	5.68	-
		002	10.35	-	1.40	-
		003	23.85	-	30.28	-
		004	29.85	4.77	24.11	7.14
		005	16.04	-	34.53	-
		006	5.06	-	1.29	-
		007	2.92	-	0.46	-
	Dohan Total		**95.78**	**4.77**	**97.76**	**7.14**
	Kantli	008	4.40	0.21	11.57	0.37
		009	19.70	-	57.65	-
		010	19.08	6.67	44.70	21.03
		011	4.82	-	18.89	-
		012	20.41	0.11	38.87	0.01
	Kantli Total		**68.42**	**6.99**	**171.68**	**21.41**
	Mendha	013	5.66	-	17.08	-
		014	14.87	0.11	75.98	0.05
		015	13.40	-	50.03	-
		016	42.01	-	139.40	-
		017	57.72	-	209.56	-
		018	43.16	3.38	208.17	37.62
		019	6.08	0.01	40.37	1.39
		020	27.85	0.03	69.12	0.15
		021	6.93	0.10	1.21	0.04
		022	5.65	0.35	0.91	0.13
		023	9.13	0.35	2.35	0.15
		024	31.16	2.22	80.12	29.28
		025	5.54	4.40	32.91	33.41
	Mendha Total		**269.16**	**10.93**	**927.22**	**102.23**
Basin Total			**433.35**	**22.70**	**1,196.66**	**130.77**
Ruparail	Ruparail	001	42.30	0.21	75.21	0.76
		002	26.76	5.68	51.99	11.16
		003	40.39	-	57.90	-
		004	5.52	-	4.23	-
		005	10.37	5.03	21.76	12.38
		006	13.67	23.39	27.36	52.39
		007	22.72	-	29.19	-
		008	2.57	1.35	1.35	0.48
		009	33.77	4.90	52.71	7.54
		010	6.94	1.18	10.52	2.16
		011	19.97	0.31	25.68	0.72
		012	45.39	7.03	80.83	20.30
		013	11.50	-	12.08	-

Basin	Sub-basin	Micro Watershed	Dynamic Groundwater Availability, Mm³		Static Groundwater Availability, Mm³	
			Fresh	Saline	Fresh	Saline
Ruparail	Ruparail	014	20.30	-	21.99	-
Ruparail Total			**302.18**	**49.07**	**472.79**	**107.89**
Banganga	Banganga	001	8.24	-	1.15	-
		002	8.39	-	0.98	-
		003	22.26	25.00	34.09	56.86
		004	6.49	1.58	13.95	3.99
		005	20.24	2.34	40.69	6.08
		006	8.59	3.77	18.86	10.11
		007	6.50	9.55	9.44	16.94
		008	18.96	19.73	24.96	28.88
		009	17.63	2.67	34.10	6.82
		010	27.79	4.28	56.55	8.99
		011	13.32	-	27.06	-
		012	3.20	5.30	5.98	11.67
		013	25.89	15.26	46.54	37.37
		014	32.61	1.85	48.83	3.95
		015	10.24	1.91	23.94	2.76
		016	31.27	1.80	54.07	3.21
		017	21.17	11.63	29.61	18.99
		018	19.45	-	29.63	-
		019	10.47	-	19.50	-
		020	17.66	-	26.83	-
		021	10.21	-	15.36	-
		022	13.84	-	15.40	-
		023	18.29	-	35.45	-
		024	8.57	-	18.32	-
		025	41.55	14.81	52.43	29.34
		026	5.82	19.59	10.85	30.41
		027	4.42	-	11.38	-
		028	8.61	-	30.26	-
		029	17.35	4.16	8.47	3.46
		030	17.36	1.88	3.66	0.29
		031	13.91	0.09	6.94	0.20
		032	35.49	-	58.28	-
Banganga Total			**525.76**	**147.19**	**813.57**	**280.35**
Gambhir	Gambhir	001	28.42	0.34	20.87	1.12
		002	51.36	12.32	82.20	27.64
		003	24.15	-	25.27	-
		004	33.77	7.02	43.85	10.11
		005	15.34	-	23.98	-
		006	26.23	4.03	26.11	5.66
		007	39.08	-	57.37	-
		008	44.74	2.73	47.86	4.89
		009	33.23	-	38.23	-
		010	25.65	3.05	33.72	7.02
		011	22.22	-	10.64	-
		012	24.32	-	23.93	-
		013	13.93	-	12.05	-

Basin	Sub-basin	Micro Watershed	Dynamic Groundwater Availability, Mm^3		Static Groundwater Availability, Mm^3	
			Fresh	Saline	Fresh	Saline
Gambhir	Gambhir	014	17.47	-	23.70	-
		015	17.31	0.27	2.55	0.38
		016	10.98	-	5.86	-
Gambhir Total			**428.21**	**29.78**	**478.18**	**56.82**
Parbati	Parbati	001	2.52	-	4.10	-
		002	10.65	-	10.32	-
		003	1.56	-	0.45	-
		004	7.83	-	2.68	-
		005	5.99	-	1.77	-
		006	4.47	-	0.77	-
		007	4.48	-	0.96	-
		008	2.88	-	0.65	-
		009	6.16	-	1.44	-
		010	2.90	-	0.86	-
		011	4.96	-	1.61	-
		012	10.03	-	12.06	-
		013	7.49	-	2.55	-
		014	4.85	-	5.74	-
		015	11.99	-	17.13	-
		016	8.58	-	7.61	-
		017	12.39	-	18.03	-
		018	8.62	-	3.93	-
		019	6.01	-	5.46	-
		020	4.13	-	5.53	-
Parbati Total			**128.50**	**-**	**103.69**	**-**
Sabi	Sabi	001	11.67	-	17.78	-
		002	11.45	-	16.35	-
		003	10.55	-	17.43	-
		004	9.11	0.02	12.61	0.12
		005	12.08	2.44	17.73	4.43
		006	25.53	-	38.05	-
		007	30.30	1.46	45.64	3.02
		008	31.16	-	44.08	-
		009	9.62	-	13.94	-
		010	18.49	-	27.55	-
		011	27.51	-	39.93	-
		012	38.19	-	48.29	-
		013	22.76	-	37.40	-
		014	26.53	-	73.73	-
		015	32.63	-	90.91	-
		016	31.75	0.00	38.04	0.01
		017	5.93	-	13.26	-
		018	19.92	3.00	30.94	6.11
		019	43.91	-	57.19	-
		020	10.80	-	17.73	-
Sabi Total			**429.89**	**6.93**	**698.56**	**13.69**
Banas	Banas	001	75.63	2.28	44.08	0.28
		002	50.67	1.12	42.65	0.07

Basin	Sub-basin	Micro Watershed	Dynamic Groundwater Availability, Mm^3		Static Groundwater Availability, Mm^3	
			Fresh	Saline	Fresh	Saline
Banas	Banas	003	54.70	1.16	58.03	3.24
		004	122.50	-	27.44	-
		005	7.98	-	0.88	-
		006	58.14	-	11.29	-
		007	14.09	0.57	2.68	0.21
		008	18.68	-	3.03	-
		009	17.39	-	3.51	-
		010	27.50	-	3.84	-
		011	20.07	0.21	4.71	0.09
		012	42.04	0.03	50.38	0.02
		013	22.03	1.19	6.52	0.07
		014	28.20	-	47.14	-
		015	11.64	-	18.10	-
		016	3.77	-	0.74	-
	Banas Total		**575.04**	**6.55**	**325.00**	**3.98**
	Berach	017	18.36	-	2.73	-
		018	75.34	-	22.17	-
		019	0.67	-	0.14	-
		020	1.85	-	0.32	-
		021	21.58	-	4.33	-
		022	9.10	-	1.17	-
		023	31.51	-	5.36	-
		024	7.51	-	2.24	-
		025	17.27	-	3.33	-
		026	8.26	-	1.76	-
		027	14.91	-	9.88	-
		028	10.28	-	4.71	-
		029	36.31	-	15.25	-
		030	1.88	-	1.25	-
		031	7.97	-	4.02	-
		032	2.85	-	1.62	-
		033	12.84	-	2.29	-
		034	24.69	-	8.37	-
		035	18.43	-	1.97	-
		036	20.81	-	3.84	-
	Berach Total		**342.43**	**-**	**96.75**	**-**
	Dain	037	35.05	0.30	3.18	0.07
		038	49.65	3.97	5.43	0.72
		039	35.67	1.41	3.65	0.47
	Dain Total		**120.38**	**5.67**	**12.27**	**1.26**
	Gudia	040	55.94	0.67	24.17	0.28
		041	7.15	-	1.04	-
	Gudia Total		**63.09**	**0.67**	**25.21**	**0.28**
	Kalisil	042	13.13	7.39	9.53	2.15
		043	9.25	13.69	14.80	25.13
	Kalisil Total		**22.38**	**21.08**	**24.33**	**27.27**
	Khari	044	1.68	-	0.19	-
		045	39.88	1.23	8.79	0.40

Basin	Sub-basin	Micro Watershed	Dynamic Groundwater Availability, Mm^3		Static Groundwater Availability, Mm^3	
			Fresh	Saline	Fresh	Saline
Banas	Khari	046	67.61	0.64	12.35	0.28
		047	14.91	4.20	3.31	0.62
		048	21.37	-	3.34	-
		049	29.17	-	4.47	-
		050	20.86	-	3.15	-
		051	21.47	-	5.32	-
		052	20.74	-	4.53	-
	Khari Total		**237.69**	**6.07**	**45.45**	**1.30**
	Kothari	053	4.08	-	0.89	-
		054	56.15	2.35	12.68	0.55
		055	21.91	-	4.88	-
	Kothari Total		**82.14**	**2.35**	**18.44**	**0.55**
	Mashi	056	65.14	-	136.76	-
		057	58.04	-	139.61	-
		058	63.31	10.93	151.53	23.86
		059	88.71	15.50	43.40	5.20
		060	28.63	10.71	17.78	2.50
		061	27.71	-	11.89	-
	Mashi Total		**331.54**	**37.13**	**500.97**	**31.55**
	Morel	062	27.42	-	50.45	-
		063	82.31	4.57	230.93	4.02
		064	37.59	-	46.24	-
		065	118.22	14.90	148.15	15.65
		066	3.74	-	0.79	-
		067	56.16	0.01	73.15	0.15
		068	115.83	3.85	199.87	3.67
	Morel Total		**441.28**	**23.34**	**749.58**	**23.50**
	Sodra	069	9.78	-	1.04	-
		070	25.85	0.07	6.78	0.05
		071	31.15	4.71	3.09	0.68
	Sodra Total		**66.77**	**4.78**	**10.91**	**0.73**
Banas Total			**2,282.73**	**107.65**	**1,808.90**	**90.42**
Chambal	Chakan	001	6.24	-	5.45	-
		002	28.57	-	6.52	-
	Chakan Total		**34.81**	**-**	**11.97**	**-**
	Chambal Downstream	003	59.09	-	11.63	-
		004	17.04	-	3.07	-
		005	38.58	26.33	30.05	22.09
		006	1.15	-	0.35	-
		007	55.31	-	52.83	-
		008	54.78	-	77.33	-
		009	26.21	-	39.76	-
		010	47.72	-	63.82	-
		011	74.69	-	73.94	-
	Chambal Downstream Total		**374.58**	**26.33**	**352.77**	**22.09**
	Chambal Upstream	012	9.28	-	2.83	-
		013	16.29	-	8.98	-
		014	10.24	-	2.98	-

Basin	Sub-basin	Micro Watershed	Dynamic Groundwater Availability, Mm^3		Static Groundwater Availability, Mm^3	
			Fresh	Saline	Fresh	Saline
Chambal	Chambal Upstream	015	10.06	-	2.72	-
		016	5.35	-	1.10	-
		017	27.92	-	2.77	-
		018	11.42	-	2.45	-
		019	8.50	-	0.88	-
		020	11.18	-	2.43	-
		021	11.99	-	1.47	-
		022	31.49	-	3.17	-
	Chambal Upstream Total		**153.73**	**-**	**31.77**	**-**
	Kali Sindh	023	42.02	-	3.77	-
		024	7.60	-	0.68	-
		025	12.11	-	1.29	-
		026	64.94	-	11.03	-
		027	5.49	-	1.31	-
		028	24.96	-	8.71	-
		029	31.20	-	3.53	-
		030	10.72	-	1.05	-
		031	22.66	-	27.25	-
		032	63.59	-	35.81	-
		033	73.70	-	17.79	-
		034	8.40	-	2.41	-
		035	30.01	-	5.50	-
		036	31.66	-	2.27	-
		037	18.62	-	1.20	-
		038	21.78	-	4.35	-
		039	30.36	-	5.31	-
		040	42.05	-	2.88	-
		041	49.28	-	10.48	-
		042	13.13	-	1.04	-
		043	73.53	-	12.70	-
		044	19.66	-	3.11	-
	Kali Sindh Total		**697.45**	**-**	**163.46**	**-**
	Kunu	045	25.60	-	2.88	-
	Kunu Total		**25.60**	**-**	**2.88**	**-**
	Mej	046	15.90	-	1.49	-
		047	10.53	-	0.91	-
		048	143.07	-	96.64	-
		049	2.28	-	0.46	-
		050	5.06	-	1.15	-
		051	7.83	-	0.72	-
		052	39.73	-	47.37	-
		053	76.04	-	18.91	-
		054	29.49	-	3.97	-
	Mej Total		**329.92**	**-**	**171.61**	**-**
	Parwati	055	69.88	-	9.36	-
		056	8.32	-	0.82	-
		057	46.34	-	37.92	-
		058	27.43	-	7.36	-

Basin	Sub-basin	Micro Watershed	Dynamic Groundwater Availability, Mm³		Static Groundwater Availability, Mm³	
			Fresh	Saline	Fresh	Saline
Chambal	Parwati	059	25.66	-	7.14	-
		060	10.25	-	3.37	-
		061	5.69	-	1.78	-
		062	9.00	-	2.60	-
		063	9.06	-	1.07	-
		064	6.81	-	0.78	-
		065	5.30	-	0.56	-
		066	105.24	-	79.49	-
		067	54.44	-	66.65	-
	Parwati Total		**383.44**	**-**	**218.92**	**-**
Chambal Total			**1,999.54**	**26.33**	**953.39**	**22.09**
Mahi	Anas	001	27.15	-	4.63	-
		002	9.82	-	2.25	-
		003	9.33	-	2.20	-
		004	17.34	-	3.56	-
	Anas Total		**63.64**	**-**	**12.64**	**-**
	Bhadar	005	10.85	-	2.39	-
	Bhadar Total		**10.85**	**-**	**2.39**	**-**
	Jakham	006	1.13	-	0.17	-
		007	9.00	-	1.06	-
		008	0.30	-	0.10	-
		009	6.54	-	1.11	-
		010	3.61	-	0.91	-
		011	8.99	-	1.48	-
		012	2.13	-	1.36	-
		013	11.62	-	4.54	-
		014	2.38	-	0.39	-
		015	5.07	-	0.83	-
		016	4.01	-	1.07	-
		017	5.23	-	1.02	-
	Jakham Total		**60.02**	**-**	**14.05**	**-**
	Mahi	018	8.09	-	1.17	-
		019	28.56	-	4.93	-
		020	35.79	-	4.15	-
		021	4.62	-	0.94	-
		022	15.43	-	2.13	-
		023	10.97	-	1.30	-
		024	14.67	-	2.84	-
		025	27.13	-	3.81	-
		026	8.83	-	1.31	-
		027	14.27	-	1.12	-
		028	25.97	-	3.59	-
		029	11.53	-	2.49	-
		030	1.75	-	0.30	-
		031	4.54	-	0.81	-
		032	11.58	-	2.34	-
		033	6.34	-	1.10	-
		034	24.30	-	3.11	-

Basin	Sub-basin	Micro Watershed	Dynamic Groundwater Availability, Mm^3		Static Groundwater Availability, Mm^3	
			Fresh	Saline	Fresh	Saline
Mahi	Mahi	035	0.75	-	0.16	-
		036	6.42	-	1.07	-
		037	19.59	-	3.11	-
	Mahi Total		**281.12**	**-**	**41.78**	**-**
	Moran	038	17.61	-	4.67	-
	Moran Total		**17.61**	**-**	**4.67**	**-**
	Som	039	0.88	-	0.23	-
		040	7.36	-	1.61	-
		041	12.73	-	2.80	-
		042	6.29	-	1.96	-
		043	4.48	-	1.16	-
		044	11.25	-	2.33	-
		045	9.25	-	1.81	-
		046	8.64	-	1.72	-
		047	5.26	-	1.33	-
		048	4.48	-	0.97	-
		049	6.66	-	1.84	-
		050	15.79	-	1.73	-
		051	13.81	-	2.00	-
		052	8.04	-	1.00	-
		053	10.86	-	2.11	-
		054	19.57	-	2.77	-
		055	9.61	-	1.83	-
		056	3.78	-	1.44	-
		057	5.11	-	0.98	-
		058	4.20	-	1.19	-
		059	3.56	-	0.46	-
	Som Total		**171.63**	**-**	**33.29**	**-**
Mahi Total			**604.88**	**-**	**108.82**	**-**
Sabarmati	Sabarmati	001	1.68	-	0.44	-
		002	6.05	-	0.78	-
		003	1.21	-	0.13	-
		004	-	1.05	-	0.62
		005	2.18	0.90	0.42	0.38
	Sabarmati Total		**11.11**	**1.94**	**1.76**	**1.00**
	Sei	006	1.58	3.78	0.37	1.71
		007	2.01	1.15	0.78	0.42
	Sei Total		**3.59**	**4.93**	**1.15**	**2.13**
	Vatrak	008	7.16	-	1.15	-
		009	15.78	-	3.41	-
	Vatrak Total		**22.93**	**-**	**4.56**	**-**
	Wakal	010	3.98	-	0.67	-
		011	6.62	-	0.99	-
		012	4.68	-	0.87	-
		013	2.24	3.29	0.48	0.75
		014	4.11	0.08	0.82	0.04
		015	3.71	0.70	0.51	0.17
	Wakal Total		**25.35**	**4.06**	**4.35**	**0.96**

Basin	Sub-basin	Micro Watershed	Dynamic Groundwater Availability, Mm^3		Static Groundwater Availability, Mm^3	
			Fresh	Saline	Fresh	Saline
Sabarmati Total			**62.98**	**10.93**	**11.81**	**4.09**
Luni	Bandi	001	14.37	-	169.82	-
		002	12.92	-	1.96	-
		003	8.96	-	1.12	-
	Bandi Total		**36.24**	**-**	**172.90**	**-**
	Bandi (Hemawas)	004	20.66	13.05	4.44	3.81
		005	10.68	3.46	1.66	0.71
	Bandi (Hemawas) Total		**31.34**	**16.51**	**6.10**	**4.52**
	Guhiya	006	12.83	-	1.98	-
		007	5.80	1.87	1.17	0.47
		008	22.14	10.54	31.68	11.51
		009	4.68	-	0.60	-
		010	12.87	-	2.03	-
		011	9.24	21.80	34.77	18.25
		012	0.02	2.99	0.02	0.15
		013	9.18	-	1.52	-
	Guhiya Total		**76.77**	**37.20**	**73.78**	**30.39**
	Jawai	014	64.62	4.37	232.81	28.42
		015	16.79	0.88	2.51	0.28
		016	6.99	9.38	1.24	2.21
	Jawai Total		**88.40**	**14.63**	**236.55**	**30.91**
	Jojri	017	38.30	2.02	198.35	16.81
		018	21.99	1.08	197.15	11.86
		019	9.32	-	66.41	-
		020	3.39	0.87	60.16	20.69
		021	10.55	-	58.23	-
		022	8.96	0.51	61.58	13.66
		023	21.11	7.37	203.35	94.68
		024	4.87	-	32.24	-
		025	63.44	0.18	451.00	4.25
		026	15.81	0.26	55.71	1.08
		027	9.38	0.19	30.32	2.42
		028	7.05	1.92	20.30	17.45
	Jojri Total		**214.18**	**14.39**	**1,434.81**	**182.90**
	Khari	029	13.99	-	93.23	-
		030	86.94	-	189.43	-
		031	16.19	-	4.21	-
		032	14.79	-	2.61	-
		033	8.37	-	0.85	-
	Khari Total		**140.28**	**-**	**290.32**	**-**
	Khari (Hemawas)	034	0.16	1.09	0.05	0.07
		035	-	2.37	-	0.27
		036	12.23	4.89	1.46	0.78
		037	5.70	5.70	0.67	1.00
	Khari (Hemawas) Total		**18.09**	**14.05**	**2.18**	**2.13**
	Luni	038	17.71	-	135.19	-
		039	18.93	-	78.98	-
		040	11.16	-	117.38	-

Basin	Sub-basin	Micro Watershed	Dynamic Groundwater Availability, Mm³		Static Groundwater Availability, Mm³	
			Fresh	Saline	Fresh	Saline
Luni	Luni	041	17.91	-	132.42	-
		042	13.02	-	82.78	-
		043	6.51	2.40	17.02	4.96
		044	28.41	2.47	25.50	0.48
		045	15.97	-	78.98	-
		046	10.25	0.06	28.07	0.19
		047	15.45	6.34	115.35	293.52
		048	7.52	2.06	95.29	31.41
		049	27.70	15.48	5.64	2.65
		050	71.15	3.62	241.62	1.04
		051	8.67	9.31	115.85	79.74
		052	18.50	1.42	187.04	5.84
		053	4.48	6.03	42.15	136.99
		054	0.21	2.93	16.70	45.42
		055	14.59	12.56	132.83	107.74
		056	5.73	-	0.54	-
		057	9.68	1.83	124.95	24.97
		058	1.54	7.48	55.82	117.68
		059	21.01	0.98	375.80	19.16
		060	7.13	21.35	91.94	151.44
		061	-	9.48	-	181.38
		062	13.56	4.20	371.51	88.10
		063	-	6.25	-	170.74
		064	9.10	49.85	134.73	429.95
		065	5.64	19.53	226.31	210.96
		066	23.40	13.18	254.18	71.17
		067	3.51	11.64	11.93	66.94
		068	13.08	10.17	177.65	115.14
		069	0.03	18.03	2.65	253.71
		070	10.91	0.47	117.31	10.08
		071	0.47	6.02	12.43	42.85
		072	11.20	0.06	198.95	2.84
		073	4.29	9.54	104.69	83.07
		074	8.09	0.02	177.97	2.38
		075	6.26	3.31	134.35	74.61
		076	4.39	1.38	139.81	29.00
		077	71.89	32.39	1,127.27	397.49
		078	11.15	0.47	160.45	11.10
		079	9.65	1.55	227.83	27.53
		080	10.38	0.28	236.41	6.17
		081	14.89	8.01	349.62	123.78
		082	10.42	2.70	234.70	34.35
		083	16.96	3.57	338.32	55.26
		084	65.95	4.37	720.71	64.09
	Luni Total		**678.41**	**312.81**	**7,757.64**	**3,575.91**
	Mithari	085	28.77	17.11	47.11	74.74
		086	26.00	-	3.29	-
	Mithari Total		**54.77**	**17.11**	**50.40**	**74.74**

Basin	Sub-basin	Micro Watershed	Dynamic Groundwater Availability, Mm³		Static Groundwater Availability, Mm³	
			Fresh	Saline	Fresh	Saline
Luni	Sagi	087	53.05	0.18	373.28	6.35
		088	5.36	-	8.23	-
	Sagi Total		**58.41**	**0.18**	**381.51**	**6.35**
	Sukri	089	4.88	8.46	14.00	30.29
		090	14.90	14.15	1.68	2.67
		091	24.59	28.36	9.93	47.55
		092	5.59	9.61	0.72	8.14
		093	8.25	-	1.10	-
	Sukri Total		**58.20**	**60.58**	**27.44**	**88.65**
	Sukri (Sayala)	094	38.10	1.53	451.10	44.83
	Sukri (Sayala) Total		**38.10**	**1.53**	**451.10**	**44.83**
Luni Total			**1,493.18**	**488.99**	**10,884.72**	**4,041.33**
West Banas	West Banas	001	4.49	-	0.46	-
		002	5.67	3.99	0.66	0.69
		003	8.78	-	0.95	-
		004	8.79	-	0.65	-
		005	3.94	-	0.52	-
		006	3.36	0.26	0.53	0.19
		007	6.59	-	0.63	-
		008	5.02	-	0.71	-
		009	7.92	-	0.68	-
		010	2.83	-	0.36	-
		011	5.86	-	0.53	-
		012	0.48	-	0.07	-
		013	1.61	-	0.24	-
		014	4.28	-	0.45	-
West Banas Total			**69.63**	**4.26**	**7.44**	**0.89**
Sukli	Sukli	001	1.33	-	0.17	-
		002	2.41	-	0.36	-
		003	5.00	-	0.67	-
		004	12.75	-	1.22	-
		005	4.55	-	0.44	-
		006	6.33	-	0.67	-
		007	4.93	-	0.53	-
		008	2.52	-	0.29	-
		009	6.36	-	1.04	-
		010	2.02	-	0.20	-
		011	3.48	-	0.48	-
Sukli Total			**51.68**	**-**	**6.06**	**-**
Other Nallahs Of Jalore	Other Nallahs Of Jalore	001	9.05	-	75.49	-
		002	11.54	-	89.56	-
		003	11.44	-	135.11	-
		004	7.14	-	64.55	-
		005	15.68	-	144.74	-
		006	12.44	-	89.28	-
		007	30.06	-	91.26	-
		008	7.84	-	1.74	-
		009	10.09	-	14.09	-

Basin	Sub-basin	Micro Watershed	Dynamic Groundwater Availability, Mm^3		Static Groundwater Availability, Mm^3	
			Fresh	Saline	Fresh	Saline
Other Nallahs Of Jalore Total			**115.28**	**-**	**705.82**	**-**
Ghaggar	Ghaggar	001	138.42	213.64	336.28	587.88
		002	101.02	233.05	148.31	533.02
Ghaggar Total			**239.44**	**446.69**	**484.60**	**1,120.90**
Outside Basin	Fragmented	001	25.96	48.87	67.02	89.17
		002	-	75.19	-	556.62
	Fragmented Total		**25.96**	**124.06**	**67.02**	**645.79**
	Sub 1	003	27.50	129.59	65.46	249.98
		004	144.07	432.43	394.39	756.17
	Sub 1 Total		**171.57**	**562.02**	**459.85**	**1,006.15**
	Sub 2	005	17.29	77.59	57.75	342.54
		006	33.61	179.99	575.48	1,101.14
	Sub 2 Total		**50.89**	**257.57**	**633.23**	**1,443.68**
	Sub 3	007	8.99	47.89	45.55	164.36
		008	0.17	105.11	8.58	504.29
		009	0.85	105.38	25.55	577.75
		010	-	28.66	-	210.79
		011	8.89	5.78	76.74	137.02
		012	27.36	44.53	132.54	361.43
		013	28.21	-	102.86	-
		014	54.16	1.16	195.31	16.65
		015	102.62	0.38	375.93	3.72
		016	24.91	-	72.35	-
		017	21.42	37.84	412.62	272.69
		018	6.28	3.63	40.43	65.92
		019	49.92	26.60	574.60	204.12
		020	19.22	193.58	84.58	1,219.33
		021	-	30.11	-	155.49
		022	4.60	15.44	16.45	54.19
	Sub 3 Total		**357.63**	**646.10**	**2,164.09**	**3,947.74**
	Sub 4	023	-	50.67	-	375.02
		024	0.02	137.50	1.10	988.32
		025	-	70.57	-	549.13
		026	88.95	-	842.93	-
		027	49.30	15.29	439.23	75.76
		028	-	46.02	-	443.19
		029	49.02	4.04	768.31	51.96
		030	22.51	2.66	511.80	53.00
		031	5.14	25.44	74.18	374.63
		032	98.34	31.77	326.57	100.23
	Sub 4 Total		**313.28**	**383.96**	**2,964.12**	**3,011.25**
	Sub 5	033	0.07	36.61	2.95	943.23
		034	13.96	8.01	302.10	553.90
		035	35.48	7.01	177.51	27.67
		036	42.66	-	274.70	-
		037	179.07	10.43	937.73	57.62
		038	23.77	16.80	1,078.70	2,094.13
		039	49.90	2.34	462.69	56.75

Basin	Sub-basin	Micro Watershed	Dynamic Groundwater Availability, Mm^3		Static Groundwater Availability, Mm^3	
			Fresh	Saline	Fresh	Saline
Outside Basin	Sub 5	040	29.66	-	273.31	-
		041	26.86	2.29	380.38	143.95
		042	11.75	55.04	384.03	843.36
		043	31.38	5.29	491.36	50.65
		044	4.05	9.30	334.31	1,074.47
		045	47.63	0.21	160.16	1.36
		046	0.09	57.27	18.85	2,785.35
	Sub 5 Total		**496.32**	**210.59**	**5,278.79**	**8,632.45**
	Sub 6	047	0.26	2.97	127.82	303.56
		048	0.16	2.96	118.50	377.28
		049	0.51	2.83	58.20	192.33
		050	0.00	3.41	3.01	199.23
		051	0.39	1.08	154.60	192.65
		052	0.89	2.65	130.83	371.16
		053	0.71	0.13	119.52	43.67
		054	0.84	0.86	186.44	146.79
		055	0.00	1.09	0.19	204.66
		056	0.62	2.55	110.66	342.23
		057	6.69	0.00	241.96	0.11
		058	3.86	0.49	243.50	138.01
		059	5.09	0.27	213.75	50.42
		060	0.60	0.77	116.56	147.94
		061	2.37	3.50	123.62	91.14
		062	0.00	5.82	0.12	24.17
		063	0.27	9.30	48.41	561.55
		064	0.28	4.01	34.99	218.46
		065	1.85	1.99	306.06	280.93
		066	0.20	2.58	18.57	407.72
		067	0.35	1.97	61.66	158.00
		068	0.03	7.02	1.04	31.96
		069	1.86	1.25	100.07	33.33
		070	2.33	9.17	4.54	23.91
		071	0.19	24.96	5.00	291.01
		072	0.60	3.51	82.47	337.00
	Sub 6 Total		**30.95**	**97.16**	**2,612.07**	**5,169.20**
Outside Basin Total			**1,446.61**	**2,281.47**	**14,179.17**	**23,856.27**
State Total			**10,613.84**	**3,621.99**	**32,914.18**	**29,725.51**

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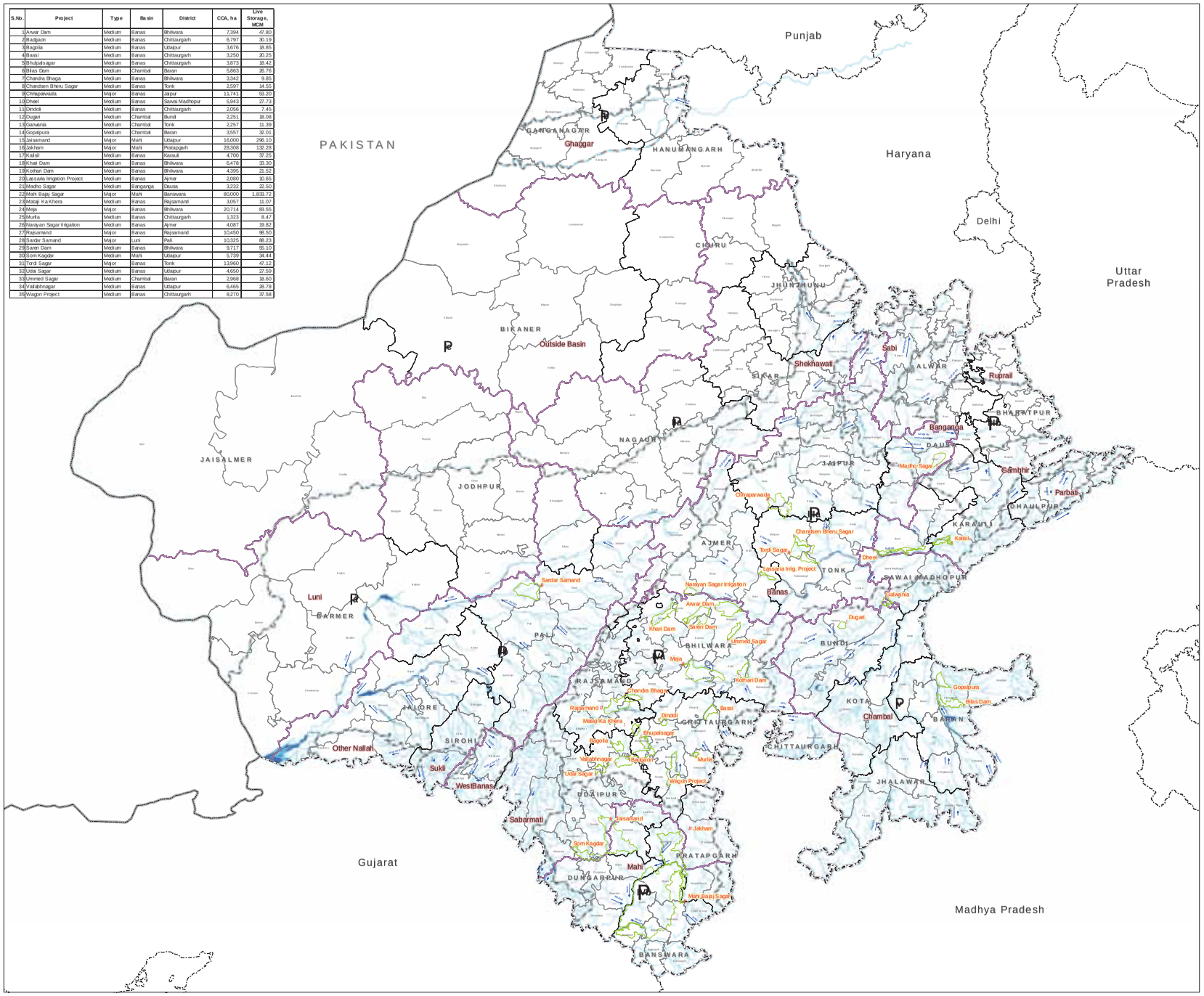
Final Report No. 4.9

Volume 3 of 3

Maps

MAP 2: MAP OF IMPROVEMENT PLANS

S.No.	Project	Type	Basin	District	CCA, ha	Live Storage, MCM
1	Anwar Dam	Medium	Banas	Bhilwara	7,394	47.80
2	Badjaon	Medium	Banas	Chittaurgarh	6,797	30.19
3	Bagoria	Medium	Banas	Udaipur	3,676	18.85
4	Baisi	Medium	Banas	Chittaurgarh	3,250	20.25
5	Bhupalsagar	Medium	Banas	Chittaurgarh	3,873	18.42
6	Bilas Dam	Medium	Chambal	Baran	5,863	36.76
7	Chandra Bhaga	Medium	Banas	Bhilwara	3,342	9.85
8	Chandsen Bheru Sagar	Medium	Banas	Tonk	2,597	14.55
9	Chhapparwada	Major	Banas	Jaipur	11,741	53.20
10	Dheel	Medium	Banas	Sawai Madhopur	5,943	27.73
11	Dindoli	Medium	Banas	Chittaurgarh	2,056	7.45
12	Dugari	Medium	Chambal	Bundi	2,251	18.08
13	Galwania	Medium	Chambal	Tonk	2,257	11.39
14	Gopalpura	Medium	Chambal	Baran	3,557	32.01
15	Jaisamand	Major	Mahi	Udaipur	16,000	296.10
16	Jakham	Major	Mahi	Pratapgarh	28,308	132.28
17	Kalisil	Medium	Banas	Karauli	4,700	37.25
18	Khari Dam	Medium	Banas	Bhilwara	6,478	33.30
19	Kothari Dam	Medium	Banas	Bhilwara	4,395	21.52
20	Lasiaria Irrigation Project	Medium	Banas	Ajmer	2,080	10.65
21	Madho Sagar	Medium	Banganga	Dausa	3,232	22.50
22	Mahi Bajaj Sagar	Major	Mahi	Banswara	80,000	1,833.72
23	Mataji Ka Khera	Medium	Banas	Rajsamand	3,057	11.07
24	Meja	Major	Banas	Bhilwara	20,714	88.55
25	Murlia	Medium	Banas	Chittaurgarh	1,323	8.47
26	Narayan Sagar Irrigation	Medium	Banas	Ajmer	4,087	19.82
27	Rajsamand	Major	Banas	Rajsamand	10,450	98.50
28	Sardar Samand	Major	Luni	Pali	10,325	88.23
29	Sarot Dam	Medium	Banas	Bhilwara	9,717	55.10
30	Som Kagdar	Medium	Mahi	Udaipur	5,739	34.44
31	Tordi Sagar	Major	Banas	Tonk	13,960	47.12
32	Udai Sagar	Medium	Banas	Udaipur	4,650	27.59
33	Ummed Sagar	Medium	Chambal	Baran	2,968	18.60
34	Vallabhnagar	Medium	Banas	Udaipur	6,465	28.78
35	Wagon Project	Medium	Banas	Chittaurgarh	8,270	37.58



Legend

Identified Irrigation Projects for Rehabilitation

- Major
- Medium
- Drainage Network
- River flow direction

Boundaries

- International
- State
- ACZ
- Basin
- District
- Block
- Command Boundary

Labels

COUNTRY

State

DISTRICT

River Basin

Irrigation Project

N

W E

S

0 20 40 80 120 160 Km

GOVERNMENT OF RAJASTHAN

WATER RESOURCES PLANNING DEPARTMENT

PLANNING OF WATER RESOURCES OF RAJASTHAN

TAHAL Consulting Engineers Ltd.

in association with

WAPCOS and INRM Consultants Pvt. Ltd.

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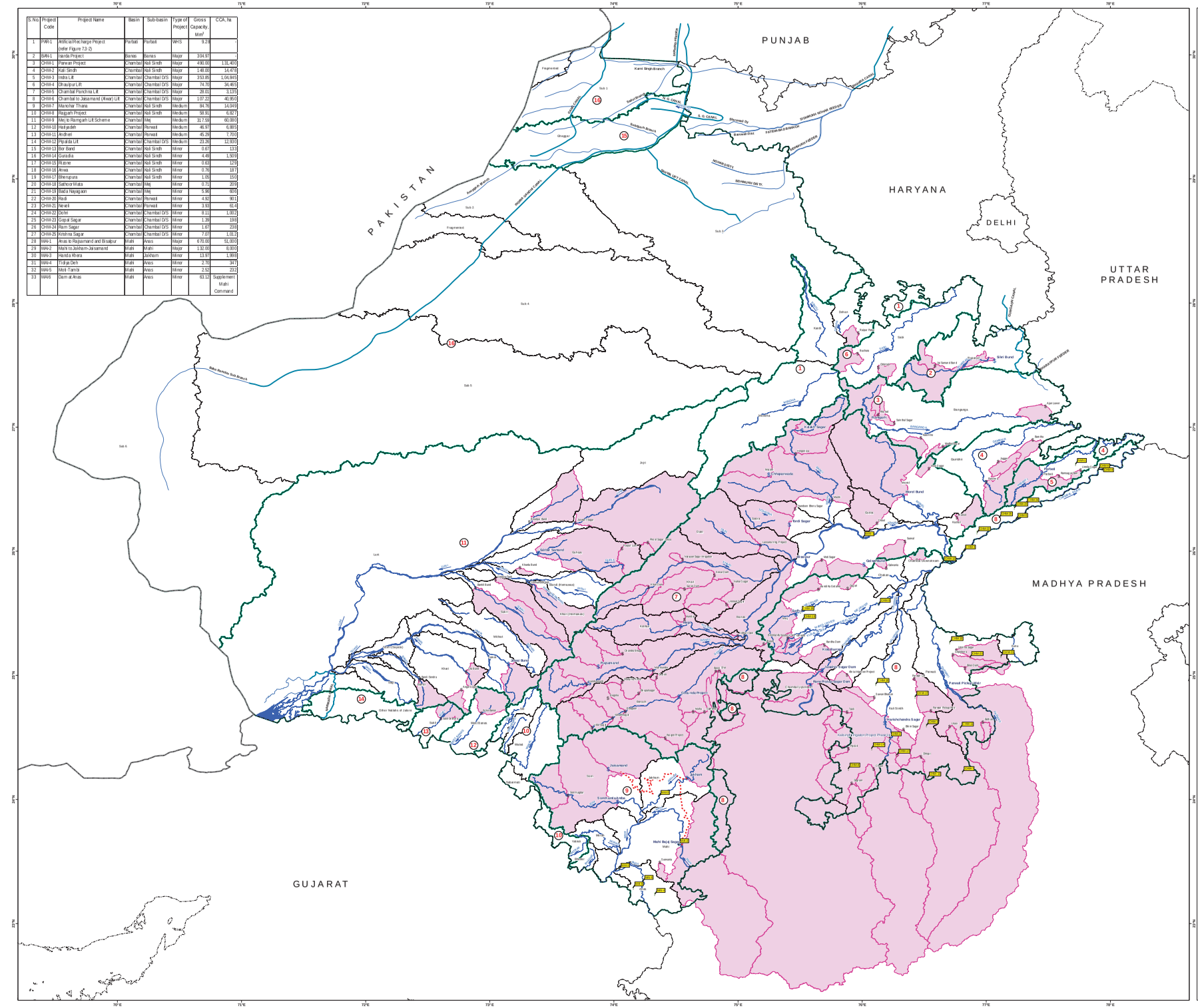
DATE: JUNE, 2014



S.No	Project Code	Project Name	Basin	Sub-basin	Type of Project	Gross Capacity, Mm³	CCA, ha
1	PAR-1	Artificial Recharge Perject (refer Figure 7.3-2)	Parbati	Parbati	MHS	9.28	
2	BAN-1	Banda Project	Banas	Banas	Major	304.97	
3	CHM-1	Parwan Project	Chambal	Kali Sindh	Major	490.00	131,400
4	CHM-2	Kuli Sindh	Chambal	Kali Sindh	Major	1,48.00	14,478
5	CHM-3	Indra Lift	Chambal	Chambal D/S	Major	353.85	1,04,945
6	CHM-4	Dhaulpur Lift	Chambal	Chambal D/S	Major	74.70	34,465
7	CHM-5	Chambal Panchna Lift	Chambal	Chambal D/S	Major	28.01	3,135
8	CHM-6	Chambal to Jalsamand (Alwar) Lift	Chambal	Chambal D/S	Major	107.22	40,953
9	CHM-7	Mainshar Thana	Chambal	Kali Sindh	Medium	94.76	14,049
10	CHM-8	Rajgarh Project	Chambal	Kali Sindh	Medium	58.91	6,827
11	CHM-9	Mej to Ramgarh Lift Scheme	Chambal	Mej	Medium	317.59	60,080
12	CHM-10	Hatigodin	Chambal	Parwati	Medium	46.97	6,865
13	CHM-11	Andheri	Chambal	Parwati	Medium	45.29	7,700
14	CHM-12	Pipalda Lift	Chambal	Chambal D/S	Medium	23.26	12,930
15	CHM-13	Bor Band	Chambal	Kali Sindh	Minor	0.67	133
16	CHM-14	Guradia	Chambal	Kali Sindh	Minor	4.49	1,929
17	CHM-15	Rajore	Chambal	Kali Sindh	Minor	0.63	125
18	CHM-16	Arwa	Chambal	Kali Sindh	Minor	0.76	187
19	CHM-17	Bhengpura	Chambal	Kali Sindh	Minor	1.05	159
20	CHM-18	Sathoor Mata	Chambal	Mej	Minor	0.71	209
21	CHM-19	Badla Nayagaon	Chambal	Mej	Minor	5.96	609
22	CHM-20	Rudi	Chambal	Parwati	Minor	4.92	901
23	CHM-21	Revali	Chambal	Parwati	Minor	3.93	614
24	CHM-22	Dohi	Chambal	Chambal D/S	Minor	8.11	1,002
25	CHM-23	Gopal Sagar	Chambal	Chambal D/S	Minor	1.36	198
26	CHM-24	Ram Sagar	Chambal	Chambal D/S	Minor	1.67	238
27	CHM-25	Krishna Sagar	Chambal	Chambal D/S	Minor	7.07	1,012
28	MAI-1	Anas to Rajsamand and Bisalpur	Mahi	Anas	Major	670.00	51,000
29	MAI-2	Mahi to Jakham-Jasamand	Mahi	Mahi	Major	132.00	8,000
30	MAI-3	Handia Khera	Mahi	Jakham	Minor	13.97	1,998
31	MAI-4	Tidiya Deh	Mahi	Anas	Minor	2.70	347
32	MAI-5	Mol-Tambi	Mahi	Anas	Minor	2.02	232
33	MAI-6	Dam at Anas	Mahi	Anas	Minor	63.12	Supplement Mahi Command

NO.	RIVER BASIN
1	SHEKHAWATI
2	RUPARAIL
3	BANGANGA
4	GAMBHIR
5	PARBATI
6	SABI
7	BANAS
8	CHAMBAL
9	MAHI
10	SABARMATI
11	LUNI
12	WEST BANAS
13	SUKLI
14	OTHER NALLAHS OF JALORE
15	GHAGGAR
16	OUTSIDE

Legend

- Existing Major Project
- Existing Medium Project
- Ongoing Major Project
- Ongoing Medium Project
- Proposed Project
- Proposed Scheme
- River
- Canal
- Branch
- Project Catchment Area

Boundaries

- International
- State
- River Basin
- Sub Basin

Labels

INTERNATIONAL

STATE

River Basin ID

Proposed Project

CANAL NAME

Projection - Transverse Mercator

GOVERNMENT OF RAJASTHAN
WATER RESOURCES PLANNING DEPARTMENT
PLANNING OF WATER RESOURCES OF RAJASTHAN

MAP 3: MAP FOR DEVELOPMENT PLANS

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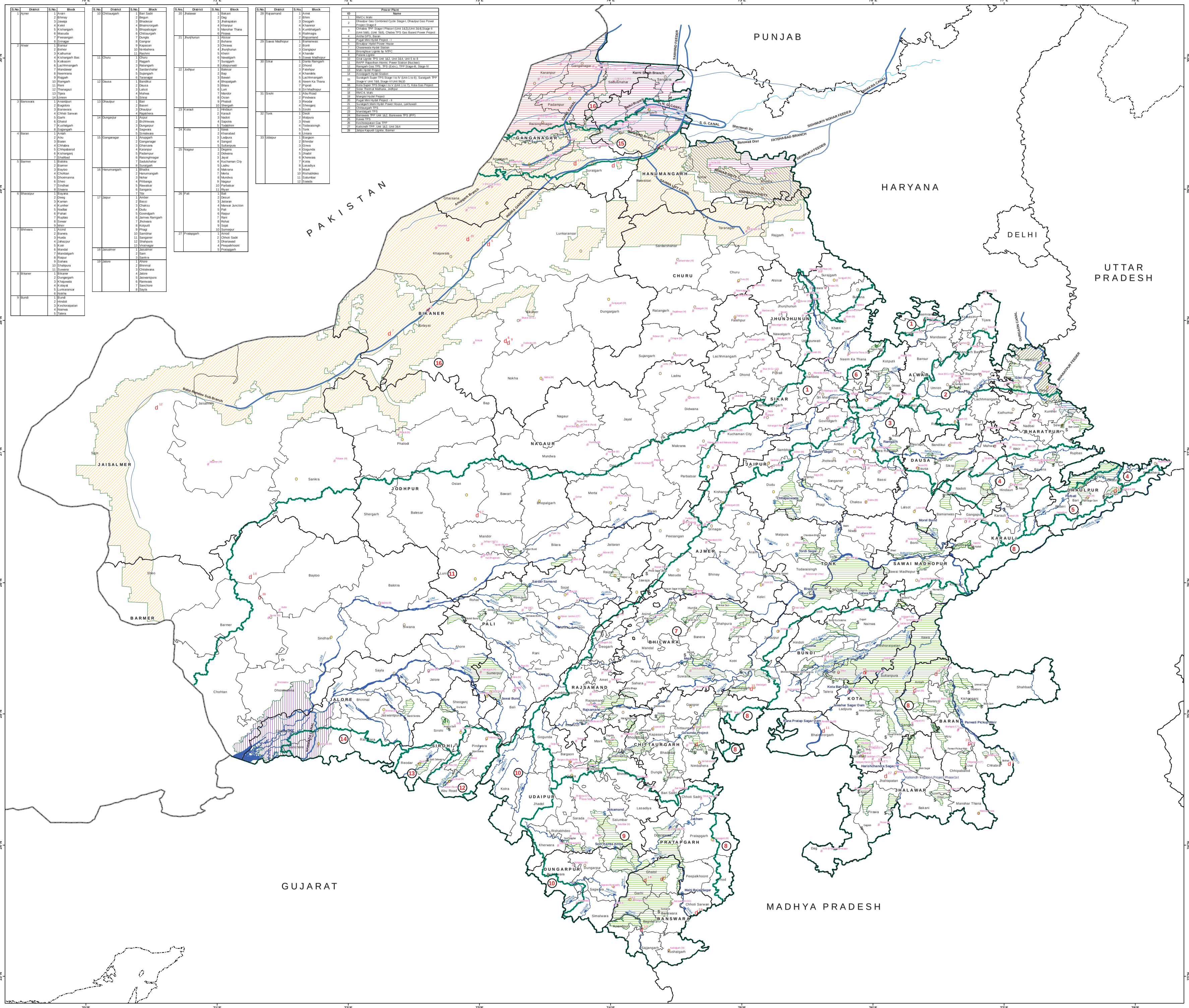

NO. RIVER BASIN

1 SHEKHAWATI
2 RUPARAIL
3 BANGANGA
4 GAMBHIR
5 PARBATI
6 SABI
7 BANAS
8 CHAMBAL
9 MAHI
10 SABARMATI
11 LUNI
12 WEST BANAS
13 SUKLI
14 OTHER NALLAHS OF JALORE
15 GHAGGAR
16 OUTSIDE

0 12.5 25 50 75 100 Km

Projection - Transverse Mercator

Legend

- Existing Major Project
- Existing Medium Project
- Ongoing Major Project
- Ongoing Medium Project
- Industries
- Power Plants
- Town
- River
- Canal
- Branch

Command Areas

- Internal Irrigation Projects
- Bhakhra Canal
- Bharatpur Canal
- Gang Canal
- Gurgaon Canal
- IGNP Canal System
- Narmada Canal
- Nohar Sidhmukh

Boundaries

- International
- State
- District
- Block
- River Basin

Labels

INTERNATIONAL
STATE
DISTRICT
Block
Major Irrigation Projects
River Basin ID
CANAL NAME

GOVERNMENT OF RAJASTHAN
WATER RESOURCES PLANNING DEPARTMENT
PLANNING OF WATER RESOURCES OF RAJASTHAN

MAP 4: MAIN FEATURES OF BLOCKS RELATED TO WATER BALANCE

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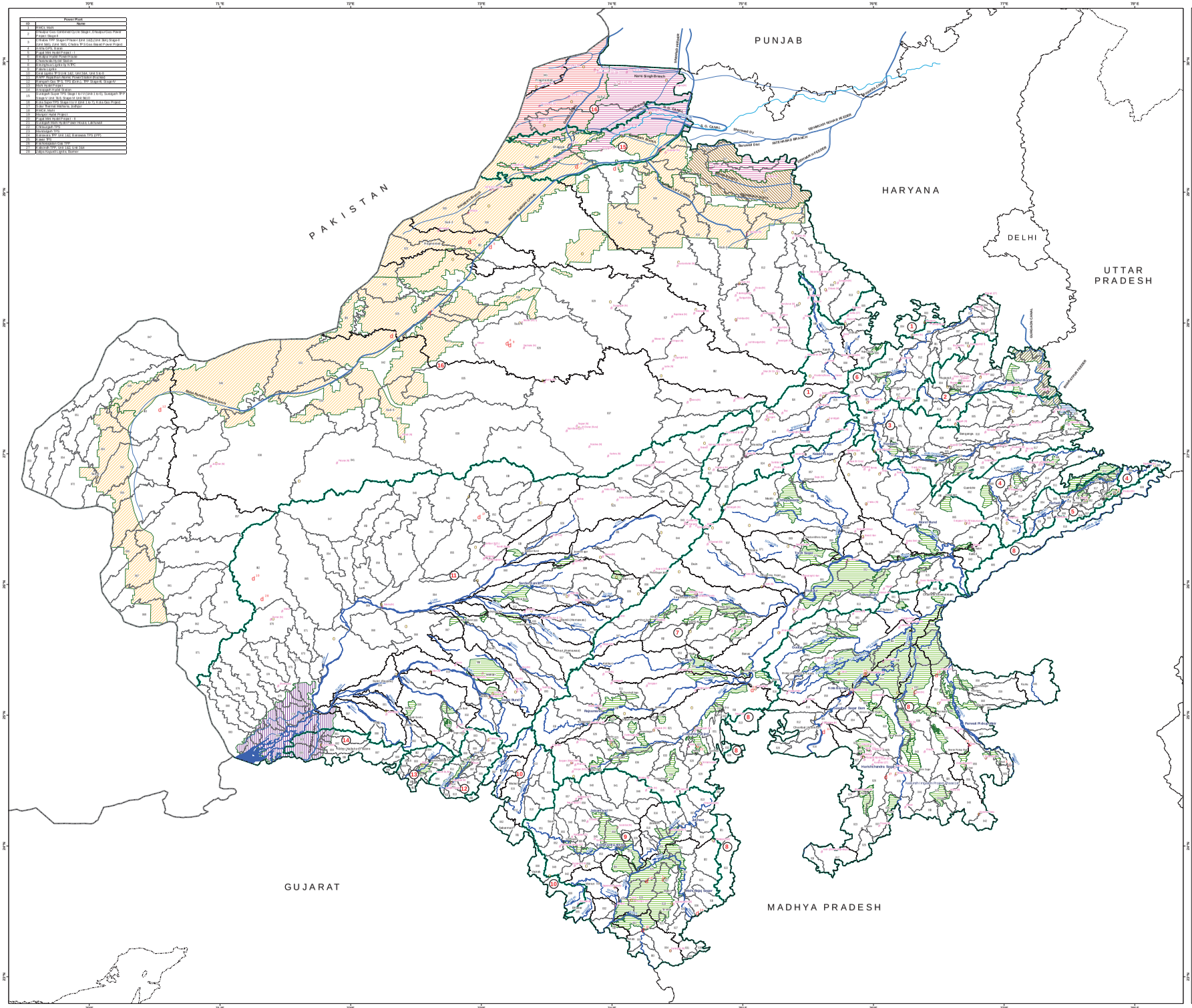

Power Plant	
ID	Name
1	RSMML Bagdi
2	Dhholpur Gas Combined Cycle Stage I (Peaking Gas Power Project Stage-I)
3	Chhabra TPP Stage-I Project (Unit 1&2) Unit 3&4) Stage-II Unit 5&6) Unit 7&8), Chabra TP S/Gas Based Power Project
4	Kota TPS
5	Kota Super Thermal Power Project
6	Ramgarh Gas Power Station
7	Dholpur Combined Cycle Power Project
8	Suratgarh Super Thermal Power Station
9	Ramgarh Extension
10	Giral Lignite TPS(Unit 1&2, Unit 3&4, Unit 5&6)
11	Kalisindh Thermal Power Project (KTPP)
12	Chhabra Gas TPS, Unit 5&6(Ext.), TPP Stage-III, Stage-IV
13	Barsingsar Lignite
14	Suratgarh Solar Thermal
15	Suratgarh Super TPS Stage-I (Unit 1 to 3), Suratgarh TPP Stage-V Unit 7&8, Stage-VI Unit 9&10
16	Kota Super TPS Stage-II (Unit 4 to 7) + Kota Gas Project
17	Kota Thermal Network, Jodhpur
18	RSMML Mahi
19	Jhalawar Mahal Project
20	Panali Mini Hydel Project - II
21	Chhabra TPP Unit 1&2, TPP Hadla, Lakheri
22	Chittorgarh TPS
23	Dholpur Gas TPP
24	Ramgarh TPP Unit 1&2, Ramgarh TPP (TPP)
25	Lunkaransar TPS
26	Jhalawar TPS
27	Kalisindh TPP, Unit 1&2, Unit 3&4
28	Chhabra Kalisindh Lignite Mahal

NO.	RIVER BASIN
1	SHEKHAWATI
2	RUPARAIL
3	BANGANGA
4	GAMBHIR
5	PARBATI
6	SABI
7	BANAS
8	CHAMBAL
9	MAHI
10	SABARMATI
11	LUNI
12	WEST BANAS
13	SUKLI
14	OTHER NALLAHS OF JALORE
15	GHAGGAR
16	OUTSIDE

Legend

- Existing Major Project
- Existing Medium Project
- Ongoing Major Project
- Ongoing Medium Project
- Industries
- Power Plants
- Town
- River
- Canal
- Branch

Command Area

- Internal Irrigation Projects
- Bhakhra Canal
- Bharatpur Canal
- Gang Canal
- Gurgaon Canal
- IGNP Canal System
- Narmada Canal
- Nohar Sidhmukh

Boundaries

- International
- State
- River Basin
- Sub Basin
- Micro-watershed

Labels

INTERNATIONAL

STATE

15 River Basin ID

CANAL NAME

N W E S

0 12.5 25 50 75 100 Km

Projection - Transverse Mercator

GOVERNMENT OF RAJASTHAN
WATER RESOURCES PLANNING DEPARTMENT
PLANNING OF WATER RESOURCES OF RAJASTHAN

MAP 5: MAIN FEATURES OF MICRO-WATERSHEDS RELATED TO WATER BALANCE

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